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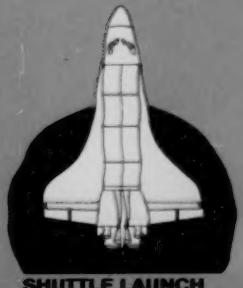

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Scientific and Technical Aerospace Reports (STAR) is a major component of a comprehensive National Aeronautics and Space Administration information system covering aeronautics, space, and supporting disciplines. *STAR* is issued on the 8th and 23rd of each month and announces current publications of the following types:

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By arrangement between NASA and the Smithsonian Science Information Exchange (SSIE), a separate section of information on aerospace-related *On-Going Research Projects* is inserted into each issue of *STAR*. The insert presents titles of active NASA grants and university contracts, summary portions of recently updated *NASA Research and Technology Objectives and Plans (RTOPs)*, and notices of non-NASA research projects that were funded in the most recent or current fiscal year. The latter are selected by SSIE. The project announcements in the insert are arranged by *STAR* divisions but are otherwise entirely separate from *STAR*. They are not indexed nor machine-searchable by NASA. Current and retrospective searches are available from SSIE, 1730 M Street, N.W., Washington, D.C. 20036.

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Subject scope of *STAR*, *IAA*, and *On-Going Research Projects* includes all aspects of aeronautics and space research and development, supporting basic and applied research, and applications. Aerospace aspects of earth resources, energy development, conservation, oceanography, environmental protection, urban transportation, and other topics of high national priority are also covered.

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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07 AIRCRAFT PROPULSION AND POWER 2522

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Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

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For related information see also *07 Aircraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

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Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
Includes educational matters.

81 ADMINISTRATION AND MANAGEMENT 2637
Includes management planning and research.

82 DOCUMENTATION AND INFORMATION SCIENCE 2637
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software*.

83 ECONOMICS AND COST ANALYSIS 2638
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE N.A.
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 2638
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 2639
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 2639
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 2640
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

92 SOLAR PHYSICS 2640
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 2641
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

GENERAL

99 GENERAL 2642

Note: N.A. means that no abstracts were assigned to this category for this issue.

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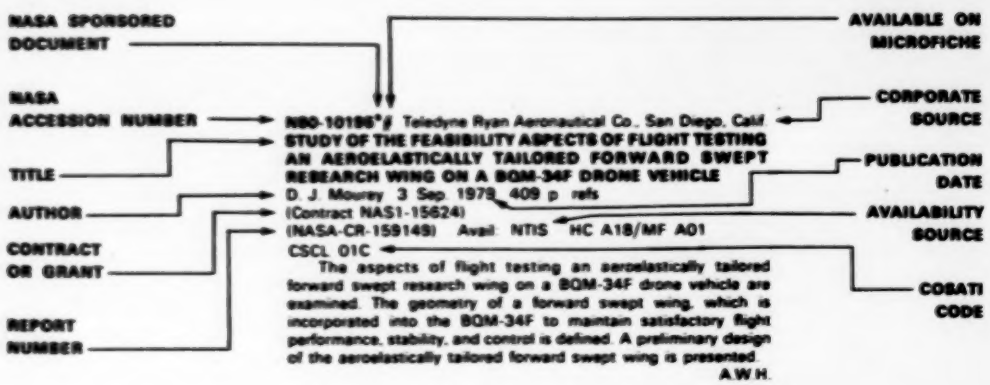
TYPICAL CITATION AND ABSTRACT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TITLE
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
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The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, AIRCRAFT/STORE INTERFACE TECHNOLOGY
C.M. Connell, U.S. Dept. of Defense, Air Force, Armament Lab., *Eglin Air Force Base, Florida* 32542 (DF646990)

Air Force function - standard aircraft/store electrical interfaces. Deficiency - currently, there is little aircraft/store electrical interoperability. Electrical interfaces are designed on a case-by-case basis with little resulting standardization. Objective - generate the technology required to apply new multiplexing techniques to future aircraft/store interfaces. How work contributes - the results of this effort will contribute to the design of a standard aircraft/store interface. This interface, when implemented, can remove one of the major obstacles to interoperability between aircraft and stores.

Problems inherent in a multiplexed interface will be studied and solutions proposed. Promising interfacing concepts will be investigated by developing hardware and software in-house for simulations and applications analyses. Fiber optics, microprocesser, VLSI and NEXTED BUS concepts will be implemented and tested.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

1.0002, NONLINEAR INTERFERENCE DETECTION
T.E. Baustert, U.S. Dept. of Defense, Air Force, Rome Air Development Center, *Griffiss Air Force Base, Rome, New York* 13441 (DF930370)

The objective of this in-house effort is to determine and extend the current state-of-the-art in hardware and measurement techniques capable of locating the sources of nonlinear interference generators on-board CCC aircraft.

The approach to be taken will include a literature search to determine what has been done by the DOD and industry in the area of locating nonlinear generators of interference. A hand-held sensitive field intensity meter is being procured for test and evaluation. If necessary, the unit will be modified to improve its sensitivity and selectivity. Once a suitable piece of hardware is available, measurements will be performed on vehicles and aircraft for the purpose of developing suitable measurement techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

1.0003, WORKLOAD PROBLEM ASSESSMENT
L.C. Butterbaugh, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF142930)

This effort supports the test and evaluation function of the Air Force. Advancements in crew station technology and mission concepts has significantly altered the crew workload associated with performing a mission. Existing technical means of assessing crew workload have not kept pace with the changes in workload. The objective of this effort is to maintain a working level familiarity with workload assessment technology and investigate potential methodologies relative to workload measurement and prediction. Such knowledge will provide the necessary understanding of operational crew workload problems and identify crew system interface areas requiring study. More efficient pursuit of workload assessment methodologies will be realized.

Literature searches of technical libraries and review of aircraft accident reports. Pilot opinion survey of aircrews in the operational commands (TAC, SAC, MAC, etc.). Promising workload assessment methodologies will be previewed for feasibility through limited-effort investigations conducted within the branch.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0004, STORE SEPARATION METHODOLOGY INVESTIGATION AND IMPROVEMENT
C.L. Dyer, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144150)

Part of the Air Force's mission is to deliver ordnance safely and accurately. The opportunity exists to enhance the utility of contractor developed store separation prediction programs. The objective of work to be performed is to provide an extensively validated design tool to assess the effects of store separation on aircraft safety and to predict the initial perturbations of stores as they are being separated from aircraft. This work will have a payoff in reducing self-inflicted damage from stores and in reducing cost associated with flight and wind tunnel tests in store certification programs, and it will allow store separation to be factored into design of both stores and aircraft.

The approach will be to exercise methods developed under contract and to compare their predictions with existing wind tunnel and flight test data. These comparisons will point out places where methods need improvement, and through the process of making comparisons it will become apparent where the methods could be implemented in a much more user oriented way. These improvements will be accomplished in-house if at all possible.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, STABILITY AND CONTROL DATA DISCREPANCIES IDENTIFICATION
S.F. Lash, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143300)

This work unit supports TPO 3, flight control, and major thrust FG02D3, aircraft stability and control prediction. Specifically, it addresses the problem area involving the differences observed between predicted and actual flight characteristics. The objective of this effort is to identify discrepancies observed during aircraft development programs between predicted values of stability and control parameters and those measured in flight. The results of this effort will be used to formulate a specific investigation of the test and analysis methods used to predict stability and control characteristics, which, will result in a more accurate mathematical representation of predicted aircraft dynamics.

Information will be obtained on several recent and ongoing aircraft development programs to identify situations where values of the stability and control parameters used for dynamic analysis and piloted simulation have led to misleading estimates

of actual flight characteristics. Following problem identification and selection, aerodynamic data, piloted simulation time histories, flight test time histories, and operational experience will be evaluated to document discrepancies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0006, FLAT PANEL SELF-HEALING VERTICAL SITUATION DISPLAY
J.R. Pastor, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF144540)

This work unit supports TP03. Criteria is required which defines a font set and sizes which will be fail-safe and fail-redundant with a specified level of probability due to pilot perception. The objective is to establish this criteria for matrix addressed alphanumerics which can be used to define limits in font variables for a matrix addressed format which is fail-safe and/or fail-redundant and self-healing. This can then be combined with hardware fail probabilities to predict useful life of new aircraft display systems.

Conduct a preliminary analysis based on the Riley and Barbato discrete element degradation experiments and on Euclidian distances from Goble. This effort will scope the modes and ranges of random and linear degradation to be experimentally evaluated. Define experiments, complete them and complete report establishing criteria.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0007, LOADS FACILITY EVALUATION
T.F. Sabick, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF143810)

There is currently no facility in the free world in which the survivability of aircraft structures can be evaluated in a realistic flight loaded condition and subjected to actual ballistic impacts. This testing is necessary to determine the structural degradation of ballistically damaged aircraft components. The objective of this effort is to provide the on-site support necessary for the installation and initial evaluation of a flight load simulation system in the Aircraft Survivability Research Facility. The data produced in this effort will be used to improve the battle-damaged structure analysis code and thereby improve survivability design studies and vulnerability assessments.

The load reaction frame and associated instrumentation and control components that comprise the flight loads simulation system will be installed in the ASRF. Evaluation and checkout will be performed utilizing replica wing specimens. Of the five replica specimens that will be used, three will have structural members removed to simulate ballistic damage. When this initial evaluation stage is complete an actual A-10 aircraft wing will be installed and tested using a typical foreign anti-aircraft round as the threat. A detailed comparison between the battle damage structure analysis code prediction and the actual wing response will then be performed.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0008, AIRCRAFT/STORE AERODYNAMIC HEATING
T.E. Durrenberger, U.S. Dept. of Defense, Air Force, Arnold Engineering Development Center, *Arnold Air Force Station, Tullahoma, Tennessee* 37389 (DF626610)

To develop an in-house capability for analytically predicting fields of aero-thermodynamic and transport properties required in aerodynamic heating analyses of USAF airframe/store bodies of concern to the AFATL, over existing/anticipated operational flight envelopes. These fields of properties, along with specific geometrical and thermal property specifications of the airframe/store bodies under consideration are required to determine transient thermal responses and steady state temperatures, i.e., temperature fields throughout the bodies.

Investigate existing capability for analytically predicting aerothermodynamic (velocities, viscosities, temperatures, etc.) and transport (effective convective heat transfer coefficients) air properties. Using these techniques, develop a method whereby fields of the above-mentioned properties may be predicted for surfaces of selected USAF airframe/store bodies over a range of flight envelopes. This effort is confined to the aero-thermodynamics of adiabatic compression and viscous heating-transient thermal responses of airframe/store bodies are not intended for inclusion hereunder.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Armament Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, CRYSTAL CHEMISTRY
M. O'Keeffe, Arizona State University, School of Liberal Arts, Dept. of Chemistry, *Tempe, Arizona* 85281 (DMR78-09197)

The ultimate goal of this project is to obtain an improved understanding of structure and bonding in inorganic solids. General structural and bonding principles are sought that will (a) enable one to rationalize and organize the enormous body of structural data already extant; (b) serve as guides to predicting the existence, structure, and properties of new inorganic solids; and, (c) help to integrate the chemistry of solids with the rest of inorganic chemistry. A major intermediate goal is obtaining a better understanding of the importance of cation-cation nonbonded interactions in determining crystal structure and stability. The program includes synthesis and structure determination of oxides and nitrides of beryllium, silicon, aluminum, gallium, and phosphorus. Included are ceramics of silicon, aluminum, oxygen and nitrogen (the 'sialon' refractories) that are important in high temperature and solar energy applications. The occurences of extended defects and ordered intermediate phases also are being explored in order to gain a fuller understanding of the structure, stability, and reactivity of these compounds.

Disorder in crystals is investigated with emphasis on sublattice melting. Finally, means of simplifying the descriptions of complicated crystal structures are being sought.

This is a continuation of work supported under DMR 72-03246. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0002, NONLINEAR ELECTROMAGNETIC SCATTERING TECHNIQUES FOR THE DETECTION AND CHARACTERIZATION OF CLOSED CRACKS
A.J. Bahr, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF053920; F49620-79-C-0005)

AF function - metal aircraft structures and turbine engine components are subject to failure by the growth of small cracks and defects introduced by fatigue and other deformation processes. Deficiency - fatigue commences immediately upon the fabrication and use of the metal article and there are inadequate nondestructive evaluation (NDE) techniques available to reject that component when catastrophic failure is imminent. Objective - the objective of this research is to develop an NDE technique capable of detecting small closed cracks on metal surfaces. How work contributes - detecting small cracks will allow parts to be rejected before catastrophic failure occurs.

Nonlinear interactions of microwave energy incident upon metal surfaces will be studied. The magnitude, source and mechanism of such interactions will be correlated with physical (strength-related) parameters of the metal surface. Closed surface cracks will be introduced, characterized and related to the nonlinear interactions in order to assess the utility of this technique for NDE applications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0003, MOLECULAR BEAM STUDIES OF TRANSLATIONAL TO VIBRATIONAL-ROTATIONAL ENERGY TRANSFER BETWEEN ATOMS AND MOLECULES
Y.T. Lee, University of California, Berkeley Campus, School of Letters & Science, Dept. of Chemistry, *Berkeley, California* 94720 (CHE75-20121 A02)

A specialized crossed molecular beam machine with a high resolution, high sensitivity velocity analyzer will be constructed and used for the investigation of energy transfers between atoms and molecules.

The new velocity analyzer is based on the detection of metastable rare gas atoms rather than ions. The high sensitivity, high resolution and low background are accomplished in the time-of-flight velocity analysis by decoupling the gating and excitation processes.

With this new machine, anisotropy of interaction potential will be investigated from the differential rotational excitation cross-sections as well as the translational to vibrational-rotational energy transfer processes between rare gas atoms and polyatomic molecules.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0004, SPECTROSCOPIC STUDIES OF MOLECULAR RELAXATION KINETICS

G.W. Scott, University of California, Riverside Campus, School of Natural & Agricultural Sciences, Dept. of Chemistry, *Riverside, California* 92502 (CHE76-01318 A02)

Dr. Scott will experimentally study radiationless transitions subsequent to excitation of specific vibronic and ground state vibrational levels of small aromatic molecules in macroscopically homogeneous samples. He will use the techniques of picosecond spectroscopy to monitor the molecular relaxation phenomena. He plans to obtain detailed kinetic behavior of specific excited states on the picosecond time scale and measure, in contrast to previous work, all competitive relaxation processes including intersystem crossing, internal conversion, vibrational relaxation, and fast photochemistry. This detailed kinetic information will test basic theoretical understanding of these processes and provide insight into these processes in more complex systems. New picosecond laser techniques will be used to accomplish these goals.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0005, THEORETICAL STUDIES OF SCATTERING DYNAMICS AND INTERMOLECULAR FORCES

H.S. Taylor, University of Southern California, School of Letters Arts & Sciences, Dept. of Chemistry, *3551 University Ave., Los Angeles, California* 90007 (CHE76-15656 A02)

Taylor plans to pursue a broad program of research in atomic and molecular physics and chemistry. Areas of interest include: (1) extensions of many-body theory to new problems concerning electron impact ionization, inelastic scattering and elastic scattering; (2) the use of many-body effective potentials in the calculation of intermolecular forces and in pseudopotentials for two electrons; (3) studies of molecular systems that dissociate to states of atoms or ions with very short lifetimes; and (4) development of a classical method for simulation of quantum atom molecule scattering problems. This work is a continuation of that currently supported by Foundation grant GP-30710X.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0006, SURVEILLANCE - BEHAVIOR OF INORGANIC MOLECULAR SOLIDS SUBJECTED TO MAGNETIC FIELDS AND TO LIGHT

E.R. Bernstein, Colorado State University, School of Science, Dept. of Chemistry, *Fort Collins, Colorado* 80523 (DN675016; N00014-75-C-1179)

Solid state devices such as transistors and radiation detectors are widely used in the Navy in communication, energy conversion, and surveillance. Molecular crystals, such as the inorganic molecular crystals to be investigated here, interact strongly with light and with magnetic fields and are therefore excellent candidates for use in solid state devices. It is the purpose of this research to investigate the interactions among the molecules and the energy transfer processes in inorganic molecular crystals with a view toward producing improved solid state devices.

Optical and zero field paramagnetic resonance techniques are being used in an investigation of intermolecular interactions, energy transfer mechanisms, and exciton kinetics in inorganic molecular crystals. environmental effects on molecular energy levels within the crystals will be characterized. The molecules chosen for investigation include rare earth and actinide borohydrides and borazine (which has physical properties similar to those of benzene). A low temperature, high resolution zero field paramagnetic resonance investigation of ground and excited states of f electron crystals will be carried out.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0007, MAGNETIZATION OF THIN MAGNETIC FILMS

D.B. Dove, State University System of Florida, University of Florida, School of Engineering, Dept. of Materials Science & Engineering, *220 Black Hall, Gainesville, Florida* 32611 (ENG76-24176)

This program is concerned with the investigation of the magnetization response of thin permalloy film segments of interest in connection with magnetic bubble propagation and logic circuits. The approach to be taken is both theoretical and experimental. The analytical method of analyzing film bar segments using a series formulation to solve the shape demagnetizing field problem will be extended to a variety of circuit element shapes. Measurements will be made using domain observations and using a small spot Kerr effect probe. Of particular concern is the resolution of the question whether it is valid to treat the magnetic material simply as a magnetic continuum or whether domain structure must be explicitly taken into account in evaluating film response to applied fields or bubble fields.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Engineering & Applied Science

3.0008, BROMINE REACTIONS OF ATMOSPHERIC INTEREST

M. Kaufman, Emory University, School of Arts & Sciences, Dept. of Chemistry, *1364 Clifton Rd. N.E., Atlanta, Georgia* 30322 (ATM77-16673)

Because of the relatively weak bond of HBr, very little atmospheric bromine exists in this form. As a result, tropospheric washout of bromine is relatively inefficient, and compared to chlorine, bromine shows enhanced transport to the stratosphere. Stratospheric bromine is a very efficient ozone-removing catalyst, also due to its reduced tendency to form non-catalytically active HBr. In order to better evaluate the effect of Br on the stratospheric ozone layer, this research will measure, in the laboratory, rate constants of a number of reactions important in the bromine catalytic cycle. These include Br plus O3 yields BrO plus O2, the basic ozone-removing reactions and Br plus H2O2 yields HBr plus HO2 and Br plus HO2 yields HBr plus O2, probably the two most important HBr-forming reactions. These measurements will be performed over the temperature range of interest for stratospheric computer modeling, namely 200-300 degrees K.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

3.0009, STABLE ISOTOPE FRACTIONATION IN NATURE

R.N. Clayton, University of Chicago, School of Physical Sciences, Dept. of Chemistry, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (EAR74-19038 A03)

This is a continuation of research supported under NSF grant GA-22711 and Amendment #1.

This project involves measurement of the isotopes of oxygen and other elements in natural materials. Specific projects include: (1) oxygen in meteorites; (2) oxygen in terrestrial sediments; (3) nitrogen isotopes in meteorites and terrestrial rocks;

(4) laboratory measurement of isotopic fractionation at high temperatures. The results will be applicable to a wide variety of important geological problems including: chemical processes during formation of the solar system; sources, materials, and formation of terrestrial shales and deep-sea sediments; significance of nitrogen in geological processes; and accurate measurement of the temperatures of formation of terrestrial rocks.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

3.0010, MAGNETIC, SPECTROSCOPIC, AND ELECTRICAL PROPERTIES OF MOLTEN SALTS

N.H. Nachtrieb, University of Chicago, School of Physical Sciences, Dept. of Chemistry, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (CHE78-12487)

This project is in the Structural Chemistry and Thermodynamics program, in the subarea of properties of the liquid state. The Principal Investigator will study solutions of metals in molten salts in order to improve our understanding of electrons in dielectric media, and the nature of the metal-insulator transition. The techniques to be used include magnetic susceptibility, electron spin resonance, vapor pressure measurement, optical spectroscopy, nuclear resonance, and thermoelectric power measurements. The measurements will be made as a function of metal concentration, to vary the electron density, and will be used to test current views of electronic behavior and electronic states in disordered systems.

This research is a continuation of that currently supported by Foundation Grant, CHE-7500680.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Chemistry

3.0011, QUANTUM MECHANICAL STUDIES OF THE COUPLING BETWEEN ELECTRONIC AND VIBRATIONAL STATES

R.J. Silbey, Massachusetts Inst. of Technology, School of Science, Dept. of Chemistry, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (CHE78-07515)

Professor Silbey will conduct research aimed at increasing theoretical understanding of processes involving interactions of solids with energy or of solid surfaces with molecules.

Research in molecular energy transfer in solids will focus on development of the theory of energy transport, including coupling between vibrational modes, vibrational relaxation, and many trapping sites. Problems to be treated are (a) the derivation of macroscopic equation governing transport from microscopic models; (b) the inclusion of both acoustic and optical modes; (c) the possibility of 'hot' transport; (d) the description of experiments on energy transport in highly mixed crystals.

In research on interactions between high and low frequency modes, Professor Silbey will apply his theories on exciton-vibration and electron-vibration coupling to the study of excited state Jahn-Teller systems which are coupled to other electronic states.

Studies will be made of models of adsorption, particularly on the effects of a nearby metal surface on the interaction between atoms. The angular dependence of the potential between linear or planar molecules and metal surfaces will be examined theoretically. Self-consistent calculations will be made of work function and surface dipole barriers and the effects of steps and ledges on electronic densities near surfaces.

This grant renews support of a research program currently supported under NSF Grant CHE-7508184.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Chemistry

3.0012, HIGH-RESOLUTION PROFILING AS A MEANS OF STUDYING FUNDAMENTAL PARAMETERS IN THE INDUCTIVELY COUPLED PLASMA

S.R. Koirtyohann, University of Missouri, Columbia Campus, School of Arts & Sciences, Dept. of Chemistry, *130 Jesse Hall, Columbia, Missouri* 65201 (CHE77-22915 A01)

Dr. Koirtyohann is studying emissions from the various regions of the inductively-coupled plasma (ICP) to understand some of the fundamental parameters involved in its operation. Although this plasma is rapidly becoming an important and analytically useful spectroscopic source, very little is known about its mechanism of operation or about the reactions undergone by analyte or sample matrix in the various regions of the plasma. Detailed profiling of atomic, ionic, and molecular emissions of the ICP will allow the full analytical potential of this source to be realized and many pitfalls in methods of development to be avoided.

Dr. Koirtyohann is using an improved method for source profiling recently developed in his laboratory which consists of a photo-diode array placed vertically near the exit slit of a stigmatic monochromator to produce a profile at a given wavelength for a complete horizontal or vertical section of the source. The resolution is better than 0.1 mm and the measurement can be made in a matter of minutes.

This profiling method is being used to study zones of intense emission, atomization and ionization processes, and distributions of temperature, analyte, and electron density within the plasma.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical
Sciences, Div. of Chemistry

3.0013, LABORATORY AND OBSERVATIONAL SPECTROSCOPIC STUDIES OF MOLECULES AND PROCESSES OF ASTROPHYSICAL INTEREST

W.H. Smith, Washington University, School of Arts & Sciences, Dept. of Chemistry, *4559 Scott Ave., St. Louis, Missouri* 63130 (AST78-12799)

This research is aimed at the elucidation and discovery of molecular spectra of species known or believed to be of substantial importance in a number of astrophysical objects, including the atmospheres of the major planets (e.g., CH4, NH3, and H2) and the diffuse interstellar clouds and comets (e.g. CH2 ion, HeH ion, H2O ion, and H3O ion). The stable species will be investigated with laser photoacoustic spectroscopy at high spectral resolution and S/N using as little as 10 to the minus 4th power of the material required by conventional methods. The spectra of the molecular ions will be investigated with laser methods, using in some cases Fourier transform spectrometers. Great sensitivity is achieved by these methods, with estimated levels of 10 to the 2nd power to 10 to the 6th power species per cc being detectable. This research represents a continuation of that currently supported by Foundation Grant AST 77-06050.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

3.0014, AB INITIO CALCULATIONS OF MOLECULAR ENERGY SURFACES

G.A. Gallup, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Chemistry, *Lincoln, Nebraska* 68508 (CHE76-17567 A01)

Gallup and coworkers will calculate molecular potential energy surfaces using an ab initio modified valence bond procedure. Initial emphasis is on determining nonreactive region interactions of H2-F, a system important in chemical laser research. Extension of these calculations to include the systems H2-C, H2-N, H2-O, and H2-S will provide information bearing upon astrophysical problems. In addition to studies on these triatomic systems, previous H2-H2 calculations will be extended to regions governing vibrational excitations. Longer range plans include calculations of H2-F in reactive regions.

The investigators are examining the use of the Hellman-Feynman theorem to improve the efficiency of energy surface calculations. Gradients in the energy calculated with this theo-

rem can, in ideal cases, provide information for use in conjunction with energies for the accurate determination of analytic representations of surfaces.

This research will provide accurate, analytic energy surfaces for molecular dynamics calculations, as well as produce useful qualitative insights into the nature of interacting systems and their wave functions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0015, PREDICTION OF TC PHASE STABILITY OF SUPERCONDUCTING COMPOUNDS

E.S. Machlin, Columbia University, School of Engineering, Dept. of Metallurgy, *351 Engineering Ter., New York, New York* 10027 (DMR77-08667 A01)

This is a continuation of a study on the effect of alloying elements on the phase stability of the stoichiometric A15 structure for binary and pseudo-binary systems of superconducting interest, which are unstable at stoichiometric composition. The pair potential model is used to develop equations for the energy as a function of composition and order. The free energy functions are employed to determine whether the application of pressure can stabilize the temperature range over which the stoichiometric composition is stable, and to determine which ternary alloying additions and how much is necessary to stabilize the A15 structures in potentially high Tc superconducting systems. To date, a correlation has been found between Tc and the minimum force constant for oscillation of an atom on a chain site with respect to its stationary nearest atoms, in the family of crystal structures containing such continuous chains of atoms but which are not in close packed planes. During the renewal period, this correlation will serve as a design procedure to identify candidate super-high Tc materials. In addition, similar correlations will be sought having potential for prediction of Tc for other families of structures characterized by electron coupling to a unique phonon mode. The ionicity modified pair potential model will be used to characterize the defects likely to affect Tc in the A15 and homologous structures, and to develop pair potential models for the Nb5Ge3 structures. These models will be used to ascertain how to bias the relative stability in favor of the A15 structure in the Nb-Ge system. This is a renewal of NSF DMR74-22493.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0016, ULTRASONICALLY STIMULATED ACOUSTIC EMISSION

D.N. Beshers, Columbia University, School of Mines, Dept. of Metallurgy, *Broadway & W. 116th St., New York, New York* 10027 (DMR77-05214 A01)

This is a continuation of studies of dynamic plasticity within solid materials by analysis of the harmonic spectrum generated by ultrasonic stimulation. The information derived from the spectrum analysis is correlated with mechanical property data and metallographic determination of the microstructure. The method, developed studying brass, will be extended to several more complex single-phase and two-phase body-centered cubic and face-centered cubic alloys. The results obtained will be used to develop a quantitative model of dynamic events which occur during the plastic deformation of metallic materials. This is a renewal of NSF grant DMR75-03236.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0017, ELECTRIC FIELD EFFECT ON MOBILITY OF GLASS CONSTITUENTS

M. Tomozawa, Rensselaer Polytechnic Inst., School of Engineering, Dept. of Materials Engineering, *110 8th St., Troy, New York* 12181 (DMR78-00727)

It is well established that the electrical conduction in conventional oxide glasses is due to alkali ions such as sodium. However, precise information regarding the behavior of such ions--their positions, number of 'free' ions, their mutual interactions, their free energy--is not well established. There is a possibility that the weak electrolyte theory is applicable to glass conductivity, and the aim of this research will be to experimentally test the theory by studying high purity glasses. Specifically the direct current conductivity and sodium diffusion coefficient in GeO2, SiO2, and PbO-SiO2 glasses will be measured as a function of alkali impurity at various temperatures. By comparing the experimental data with the electrolyte theory, the applicability of the theory to glasses will be examined and various thermodynamic quantities such as dissociation constant and activity coefficient of alkali ions will be determined. These quantities are valuable in understanding electrical and dielectric phenomena, ion-exchange process as well as ion-cluster (pair and triple ion) formation in glasses.

This is a continuation of research initiated under NSF Grant DMR73-02536A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0018, SUPPORT OF THE MATERIALS RESEARCH CENTER

C.S. Smith, University of North Carolina, Chapel Hill Campus, Materials Research Center, *Chapel Hill, North Carolina* 27514 (DMR76-80683 A01)

Work will be continued on the preparation and uses of chemically modified surfaces and on synthesis of high conductivity materials. This award will permit the completion of the research under way and an orderly transition of the most promising work to other support.

This award is a continuation of DMR76-80583.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0019, FUEL EVALUATION AND DEVELOPMENT

P.C. Hayes, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF462070)

To evaluate and characterize aircraft fuels produced from petroleum as well as those from sources such as coal liquids and shale oil, to develop and characterize synthetic fuels for specific missile systems, to provide essential support in fuels technology to ASD, operational commands, and other DOD agencies.

State-of-the-art laboratory techniques will be used for characterizing synthetic fuels as well as distillate fuels produced from petroleum, coal and shale oil. Evaluation techniques for characterizing fuels will be developed or improved as needed. Selected materials will be characterized and submitted to other organizations for testing, i.e., AFAMRL and AFML for toxicology and material compatibility testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0020, CHEMICAL VAPOR DEPOSITION AND CRYSTAL GROWTH OF A15 SUPERCONDUCTING MATERIALS

K.E. Spear, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Ceramic Science, *116 Deike Bldg., University Park, Pennsylvania* 16802 (DMR78-10054)

This work is a continuation of fundamental research on the synthesis and characterization of A15 superconducting materials such as niobium-germanium (Nb3Ge), vanadium-silicon (V3Si), and vanadium-germanium (V3Ge). These studies will provide the fundamental thermodynamic and phase equilibria information necessary for the successful synthesis of these technologically important materials. The objective is to obtain a basic understanding of thermodynamic properties and phase equilibria pertinent to synthesis of these materials by vapor phase growth and growth from the melt.

The major emphasis will be on synthesis via chemical vapor deposition. Quantitative models will be developed for predicting deposit compositions, deposition rates and deposit morphologies. The major characterization techniques will be x-

ray diffraction for phase identification and to measure lattice parameter as a function of stoichiometry.

This grant is a continuation of research initiated under NSF Grant DMR75-05813.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0021, INTERNAL-STATE ENERGY DISTRIBUTIONS IN THE PRODUCTS OF REACTIONS INVOLVING ELECTRONICALLY EXCITED ATOMS

W.H. Breckenridge, Utah Higher Education System, University of Utah, School of Letters & Science, Dept. of Chemistry, *1400 E. 2nd S., Salt Lake City, Utah* 84112 (CHE77-07603 A01)

A special appuratus for dynamical studies of the dissipation of energy in collisions of short-lived electronically excited atoms with small molecules is being constructed. Excited atoms will be created by pulses from an excitation laser, and the initial internal-state energy distributions of chemical or energy-transfer products of the collisions of the excited atoms with quencher molecules will be determined by the laser-induced fluorescence technique under essentially collision-free conditions.

Quenching processes of a wide variety of excited atoms and molecular quenchers will be studied with the proposed apparatus. Initial experiments will be concentrating on the quenching of excited states of Li, Be, and Mg by the simplest molecular quenchers: H2, HD, and D2. Such experiments will provide detailed dynamical information which can be subjected to detailed theoretical interpretation due to the relative simplicity of the potential surfaces involved.

This work is a continuation of that currently supported by Foundation grant, CHE 7512851.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0022, INTERSTELLAR ASTRO-CHEMISTRY

E. Herbst, College of William & Mary, Williamsburg College, School of Arts & Sciences, Dept. of Chemistry, *Ewell Hall, Williamsburg, Virginia* 23185 (AST79-04529)

The program consists of a study of interstellar astrochemistry. Three areas of activity are involved: Theoretical studies of low temperature chemical processes in interstellar clouds; an expansion of dense cloud modelling calculations to include more complex molecules; and a new look at the onset of dust condensation in novae and other objects. The study will look at the rates at which the chemical reactions producing complex molecules proceed under the physical conditions in interstellar clouds, the possible branching of the reaction paths to form alternative molecules, and the forward and backward balance of the reactions. The question of whether the theory can explain enough about the formation of the 15 to 20 observed complex molecules in a typical cloud lifetime or whether other processes are needed will be examined. In addition, the formation of condensation centers and growth rates of dust particules will be studied. There are now many experimental results against which the results of these studies can be compared.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Eacth & Ocean Scis., Div. of Astronomical Sciences

3.0023, A PRECISION DILATOMETER STUDY OF QUENCHED METALS AND ALLOYS

P. Wilkes, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Mineral & Metallurgical Engineering, *Madison, Wisconsin* 53706 (DMR76-04730 A01)

This is a continuation of a basic study of select quenched metals and alloys, using an ultrahigh sensitivity capacitance micrometer, with demonstrated sensitivity of less than 1 A and a long term stability of less than 20 A. This technique is being used to determine the vacancy volume of nickel where the enthalpy (Ef) and vibrational entropy (Sf) for vacancy formation are known. It will also be used to determine Ef and Sf on quenched gold and dilute gold alloys. This is a renewal of NSF Grant DMR76-04730.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0024, SOLIDIFICATION STUDIES OF ALLOYS IN MONOTECTIC AND EUTECTIC SYSTEMS

A. Hellawell, University of Wisconsin, Milwaukee Campus, School of Engineering & Applied Science, Dept. of Materials Engineering, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (DMR79-08820)

This is a fundamental investigation of the solidification of binary and ternary alloys. The objective is to improve the understanding of the mechanisms of isothermal and monovariant reactions. The first area of research involves monotectic reactions in which conditions permit coupled growth. The alloys to be investigated are Al-In, Cu-Pb, Sn-S and In-S. Transparent organic materials will also be studied to move directly observe what happens at the continuous growth front in hypermonotectic alloys. Monotectic alloys Cu-Pb, Al-In, Sn-S with fibrous composite structures will be examined by X-ray and electron diffraction methods to determine the presence or absence of preferred epitaxial orientations between the phases. Very careful directional solidification studies of cast iron of variable silicon contents will be undertaken to observe the freezing rates and temperature gradients at which there is a transition from grey to white iron. The interfacial under-cooling will also be measured. The morphological and crystallographic complexities of fine graphite will be investigated employing optical, transmission electron and scanning microscopic techniques.

This is a continuation of research previously supported under NSF Grant DMR77-11293. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0025, RELATIONSHIPS BETWEEN STRUCTURE AND STABILITY OF METALLIC GLASSES

F. Abeles, Universite de Paris, *Paris, France* (DF053520; AFOSR-78-3701)

AF function - advances in control and communications depend directly upon the reliability and performance of electromagnetic devices which are in large measure dependent upon solid state materials with special and unique properties and behavior. Opportunity - metallic glasses provide a new class of amorphous materials with unusual semiconducting, magnetic optical, mechanical and chemical properties. However, the relationship between electronic structure and the stability of these amorphous alloys needs better understanding of their thermodynamic and physical characteristics. Objective - specifically, the objective of this research is to conduct a fundamental investigation of the electronic structure of some typical amorphous metallic alloys as a function of their composition based on the interpretation and analysis of their optical and electrical properties. Semi-transparent thin films of binary and ternary alloys will be prepared by controlled codeposition of such constituents as Au, Ag, Pd, Ge, Si, Cu, under ultra-high vacuum. Measurements will be performed in situ at any temperature between 10K and 400K. How work contributes - amorphous alloys provide a new class of electromagnetic materials for applications in electronic communications and control. A thorough and fundamental understanding of their unique properties and characteristics will be important for new device concepts and applications.

The relationships between the electronic structure of some metallic alloys and their glass-forming ability as a function of composition will be investigated by a thorough analysis of their optical and electrical properties. Alloys between a noble or transition metal and Ge or Si will be considered. The sample will be uncontaminated thin films, prepared by co-evaporation on cold substrates over the whole composition range and submitted in situ, to controlled heat treatments in order to modify their atomic structure and determine the stability of the different forms. The sample atomic structure at each annealing stage will be deduced from electron diffraction and electron microscopy

experiments, combined with in-situ resistance measurements. The complex dielectric constant will be accurately determined for each form at the same (low) temperature from in-situ reflectance and transmittance measurements and analyzed in terms of intra- and inter-band contributions. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, LIGHTWEIGHT HYDROGEN MASER FREQUENCY STANDARD

H.E. Peters, Sigma Tau Standards Corp., *Tuscaloosa, Alabama* (DF905420; F19628-79-C-0104)

The objective of this effort is to design and construct laboratory prototype, lightweight, small size, low-cost, hydrogen maser frequency standards. Potential applications include improved precise navigation, tracking, satellite and space systems, and secure communication networks.

Specific feature of this investigation is a novel design approach utilizing electrode structures placed circumferentially and around the atomic storage bulb of a hydrogen maser. These electrodes concentrate and orient the oscillating magnetic field and enhance the quality factor in such a way that oscillating properties of these masers are comparable to conventionally constructed masers of much larger size.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0002, ENGINEERING RESEARCH INITIATION - WAVE DIAGNOSTICS FOR A QUASI-CW TOKAMAK

P.M. Bellan, California Inst. of Technology, School of Engineering, Dept. of Engineering & Applied Science, *1201 E. California Blvd., Pasadena, California* 91109 (ENG78-05784)

A new toroidal plasma research device currently being constructed at Caltech will be used to study wave behavior in a very high repetition rate TOKAMAK-type plasma. The quasi-continuous wave nature of this plasma will permit use of certain signal averaging techniques for the first time on a TOKAMAK plasma that will allow study of wave propagation in TOKAMAKs in much more detail than has previously been possible. Initial experiments on the device will examine (a) propagation of lower hybrid waves in TOKAMAKs; (b) mode conversion of Bernstein waves to electromagnetic modes at the upper hybrid layer; and (c) self-excited plasma modes.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Electrical Computer & Systems Engineering

4.0003, VERY-LOW-FREQUENCY PROBING OF THE MAGNETOSPHERE FROM VOSTOK STATION, ANTARCTICA

R.A. Helliwell, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (DPP78-18316)

The Stanford University Very-Low-Frequency Group will provide a Winter-Over Exchange Scientist at the USSR station at Vostok, Antarctica, for 1979, 1980, and 1981. While at Vostok, the U.S. Exchange Scientist will operate VLF, micropulsation, riometer, and electric field instruments for several U.S. programs there.

Logistic support is required to transport the U.S. Exchange Scientist and his equipment and supplies to Vostok Station during the austral summers of 1978/1979, 79/80, and 80/81.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

4.0004, DYNAMICS OF LARGE SYSTEMS

T.R. Kane, Stanford University, School of Engineering, Dept. of Applied Mechanics, *Stanford, California* 94305 (ENG77-04449 A01)

The research program will investigate the dynamics of large structural systems, such as those encountered in the study of human motion, and in problems involving the motions of flexible space vehicles and road vehicles.

The objective is to facilitate both the formulation of the governing equations and the extraction of useful information from these equations, and to apply these general concepts to selected specific problems.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0005, DESIGN AND IMPLEMENTATION OF MULTI-INPUT ADAPTIVE SIGNAL EXTRACTORS

W.A. Gardner, University of California, Davis Campus, School of Engineering, Dept. of Electrical Engineering, *Davis, California* 95616 (DF055250; F49620-79-C-0086)

AF function - digital signal processing for such applications as radar, telemetry, and communications. Deficiency - increasingly stringent requirements in communications, reconnaissance, and flight control among others, create corresponding demands in the area of signal processing. The high costs in size, weight and power have to be reduced, while speed and accuracy of the processors have to be improved. Objective - improvements in signal extraction performance, in the cost of implementation, and speed of operation of digital filters. How work contributes - the results of this research could be directly usable in the design of future Air Force electronics equipment.

The concepts of adaptive noise cancellation will be generalized to the area of adaptive signal extraction. The method depends on having two or more filter stages with appropriate feedback and variable or adaptive gains. Residue arithmetic will be exploited for speed and accuracy.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0006, STUDY OF UNSTEADY HYDRO- AND AERODYNAMICS OF LIFTING SURFACE OF HIGH ASPECT RATIO WITH CURVED CENTER LINE

H.K. Cheng, University of Southern California, School of Engineering, Dept. of Aerospace Engineering, *3551 University Ave., Los Angeles, California* 90007 (ENG75-21425)

An unsteady lifting surface theory will be developed for platforms of high aspect ratio, taking into account the sweep and the curvature of the center (lifting) line. The resulting formulation reveals significant departure from the classical theory in three-dimensional (3-D) effects in the form of strong local corrections and in the influence of the far wake. A fundamental feature brought out unambiguously by the general theory is the self-averaging effect of the high-frequency components incuding those in the unit Strouhal number range; namely, the 3-D effect contributed by the far wake, which depends (globally) on the spanwise circulation distribution, averages itself out to zero (or to a negligible quantity), as soon as the wavelength (based on the frequency and the flow speed) is short compared with the wing span. However, the local 3-D corrections associated with the sweep and curvature remain important in all frequency ranges. Specific areas of investigation are: 1) 3-D effects on lift, moment, thrust, propulsive efficiency and wake energy, and their control. 2) Analysis in the lower frequency ranges. 3) Computations by vortex-lattice and other numerical methods to verify accuracy of theory and to explore its potential for correlating unsteady wind data.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0007, OIR SURFACE STATE NOISE IN SI

C.T. Sah, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 En-*

gineering Hall, Urbana, Illinois 61801 (DF902990; F19628-77-C-0138)

AF function - signal processing and communication. Deficiency/opportunity - the presence of interface (surface) states which degrade the efficiency of the charge transfer process and increase the noise of CCD and related device structures basic to advanced signal processing circuitry. Objective - to minimize and control the effects of interface states on device operation through the development of circuit models for the noise generators in these devices. How research contributes - the analysis and measurement of noise spectral data will allow the construction of appropriate circuit models and increased understanding of the origin of the interface states will aid in minimizing and controlling device effects through processing modifications or design changes.

To take and analyze noise data in MOS transistor and CCD-like structures in order to understand the origin of the interface states and to develop detailed circuit models to describe the L/F noise generator in the equivalent circuit models of these devices. Noise measurements spectra as a function of bias conditions, frequency, temperature and interface surface state density will be taken and analyzed by high-speed automatic techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0008, DESIGN ANALYSIS AND CRITICAL COMPONENT DEVELOPMENT FOR ADVANCED GAS TURBINE ENGINE TURBINES

J. Fagan, General Motors Corp., *4700 W. 10th St., Indianapolis, Indiana* 46206 (DF462590; F33615-77-C-2091)

Develop technology for a variable geometry turbojet engine complement high specific flow/high stage loading compressors, provide a basis for high performance with recognized durability and life cycle cost controls.

Use proven analysis and design techniques to define and address limiting turbine technologies. Transfer projected engine usage data into useful test planning and design information to account for system development variability on system life-cycle cost trade-offs.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0009, LYMAN-ALPHA SOURCES FOR PLASMA STUDIES

D.W. Koopman, University of Maryland, College Park Campus, Inst. for Fluid Dynamics & Applied Mathematics, *College Park, Maryland* 20742 (ENG75-02618 A01)

This program will continue research directed toward investigating the properties of coherent ultraviolet light sources obtained by frequency conversion of ruby and other long-wavelength sources. Emphasis will be placed on conversion mechanisms based on frequency-tripling and two-photon resonant mixing in rare gases. The work will be directed first to the generation of Lyman-alpha radiation (1215 A) using tripling of a dye laser source in krypton. This will be followed by an investigation of two-photon resonance in rare gases to achieve improved conversion efficiency.

This is a continuation of research previously supported under NSF grant ENG-7502618.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Chemical & Process Engineering

4.0010, THEORY AND COMPUTATION OF SINGULAR OPTIMAL CONTROLS

W.F. Powers, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Aerospace Engineering, *Ann Arbor, Michigan* 48104 (ENG77-16660)

This research deals with problems, such as the choice of the trajectory for the space shuttle, in which use of fuel or similar resources must be minimized. The principal investigator deals with the theory and the computational practice of the treatment of such problems and of the special difficulties (the so-called 'singularities') that must be overcome in their solution. It is an unusually successful and useful line of research.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0011, RESEARCH INITIATION - EXCITATION SPECTROSCOPY OF SEMICONDUCTORS IN THE INFRARED

S.A. Lyon, Princeton University, School of Engineering & Applied Sciences, Dept. of Electrical Engineering, *Box 430, Princeton, New Jersey* 08540 (ENG79-08420)

This program combines research on the excitation spectroscopy of semiconductors in the infrared with work on color center lasers. The major thrust of the program lies in the spectroscopy area with initial emphasis placed on understanding the excited state spectra of excitons bound to shallow impurities in silicon. The study of excited states of bound excitons in silicon for deeper impurities and isoelectronic traps is also of interest. Nonradiative recombination centers are being investigated using excitation spectroscopy. A color center laser is the excitation source for the spectroscopic studies and the laser itself is the object of research. It is intended to develop a system in which a semiconductor diode laser replaces the currently used ion laser as a pump source for the color centers.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0012, COHERENT ANTI-STOKES RAMAN SCATTERING IN A WAVEGUIDE

R.B. Miles, Princeton University, School of Engineering & Applied Sciences, Dept. of Aerospace & Mechanical Science, *Box 430, Princeton, New Jersey* 08540 (ENG78-11524)

Optical waveguiding techniques are being applied to spectroscopic measurements on adsorbed species and constituents of electric discharges. The technique is based on coherent anti-Stokes Raman scattering and involves use of a tunable dye laser and a frequency doubled neodymium doped yttrium-aluminum-garnet laser. The adsorbed species measurements involve pyridine adsorbed to alumina slabs that form the walls of a tapered waveguide. The discharge work involves the diagnostics of fast recombining plasma-excited species in a hollow waveguide containing a pulsed transverse electric discharge.

This is a continuation of research previously supported under NSF grant ENG-7709283.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0013, ROTOR HEAT TRANSFER

M.G. Dunn, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DF464430; F33615-79-C-2075)

Measure the heat transfer to a full turbine stage using a shock tube as the hot gas source.

Fabricate the test section and instrumentation designed under a previous program and perform verification of technique testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0014, INVESTIGATION OF ROTATING STALL & TURBINE HEAT TRANSFER IN AXIAL FLOW TURBOMACHINERY

G. Ludwig, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DF451440; F33615-76-C-2092)

The objectives of this program are to improve understanding of rotating stall, surge and noise in axial flow compressors, to improve and demonstrate a prototype rotating stall control system for a J-85 engine, to apply transient testing techniques to the measurement of heat transfer rates to turbine engine components.

A combined theoretical and experimental approach will be utilized. The theoretical studies will include continued development of a unified aerodynamic-acoustic analysis of compressor flows as well as extending the stability theory to include vari-

able annulus area, lower hub to tip ratios and supersonic rotors. The experimental work will include rotating cascade testing, J-85 engine testing, shock tunnel tests and environmental testing of Area B at WPAFB to determine what, if any, CRF reingestion problems exist.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0015, EXPENDABLE GASIFIER

H. Due, Teledyne CAE, *1330 Laskey Rd., Toledo, Ohio* 43612 (DF459100; F33615-76-C-2055)

Complete the design of an expendable gasifier which is applicable as the core of either a 230 hp jet fuel starter, a 230 pound thrust turbojet, or a 500 pound thrust turbofan engine for a remotely piloted vehicle.

Modify the existing design to obtain an optimum configuration, fabricate and extensively test the optimum configuration.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0016, RAMJET FLUID DYNAMICS

J.E. Drewry, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF458790)

The objective of this effort is to conduct experimental and analytical studies of fluid dynamic and chemical kinetic phenomena related to advanced ramjet propulsion systems, with particular emphasis on the sudden-expansion dump combustor.

Experimental studies of non-reacting and reacting combustor flowfields will be performed using an axisymmetric sudden-expansion dump combustor test configuration. Detailed measurements of total pressure, static pressure and gas species concentrations will be made within the combustion chamber for various combustor geometries and inlet conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0017, J-79 B/AL FOD IMPACT TRANSIENT ANALYSIS

T.G. Fecke, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF460190)

The objective of this program is to establish a foreign object damage (FOD) transient stress analysis prediction model. Computer support services shall be required to conduct an in-house transient analytical simulation of starlings impacting J-79 B/Al composite blades.

The composite blades shall be modeled utilizing the NASTRAN finite-element computer program due to the availability of a transient analyses capability. Stress/strain failure modes of the composite blades will be identified. Two-dimensional bird impact loading functions developed from paralleling J-79 B/Al contractual studies shall be input to the finite element model as a function of the chord distance and impact time. The actual three-dimensional J-79 B/Al blade will be modeled using NASTRAN and both isotropic and orthotropic material property models of the blade shall be analyzed. The experimental data obtained under the FOD improvement program being completed at General Electric shall be used for comparisons with the finite-element analytical results to define the reliability of these analytical methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0018, TURBINE ENGINE LUBRICANT RESEARCH

H.A. Smith, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF451270)

Establish basic parameters of turbine engine lubricant degradation from which new and improved methods and guidelines for assessing and defining the performance capability of current and advanced high temperature lubricant can be made. Correlate the physical and chemical characteristics of wear particles with the mechanisms of wear occurring in turbine engine lubrication systems. Investigate and develop monitoring techniques for lubricant systems. Investigate foaming characteristics of turbine lubricants and the effects of find filtration on lubricant foaming as well as other lubricant properties.

Develop and utilize analytical methods of analyses for correlating lab evaluations and full scale engine experience. Study wear mechanisms through ferrography and other lube wear metal analysis techniques satisfactory for field use.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0019, EVALUATION OF METAL/GAS CELLS FOR AEROSPACE POWER SOURCES

D.R. Warnock, U.S. Dept. of Defense, Air Force, Aero Propulsion Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF456340)

To characterize the voltage, thermal and cycle-life performance of metal-gas (especially nickel-hydrogen) cells, constructed in-house and also developed under contractual programs. To provide in-house support to contractual hybrid (metal-gas) cell technology development programs.

Design and construct NiH2 cells in-house. Obtain contractually supplied NiH2 cells of various designs. Evaluate these cells to determine their performance characteristics and cycle-life under various cycling profiles. Determine the thermal characteristics of lightweight cells under cycling load in a simulated space environment. Test thermal model NiH2 battery for proposed space flight experiment. Perform studies of metal gas technology applications and develop applicable computer models.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0020, AFAPL SENIOR INVESTIGATOR PROGRAM

J.D. Pinson, University of Dayton, Research Inst., *300 College Park Ave., Dayton, Ohio* 45469 (DF461700; F33615-77-C-2069)

The objective of the AFAPL senior investigator program is to obtain assistance in solving complex and persistent problems involving airbreathing propulsion (turbine engine and ramjet engine), aviation fuels and lubrication, fire protection, and related systems and materials.

A separate and specific task is established to perform work for each individual area of study when a need is identified. Principal investigator is responsible for assigning a senior investigator to perform each task.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0021, LASER RADAR DESIGN STUDY

J. Buckley, General Electric Co., *3198 Chestnut St., Philadelphia, Pennsylvania* 19101 (DF581690; F19628-78-C-0204)

AF function - vehicle tracking, trajectory prediction, interception. Deficiency - insufficient information on a timely basis of the atmospheric density and variations in density at altitudes ranging from 8 to 30 kilometers as is required for advanced reentry systems. Objective - the development of a satellite-borne laser radar system capable of providing near real-time, remote density measurements at stratospheric altitudes and below. How research contributes - the laser radar system will provide near real-time measurements of the total density of the probed regions of the atmosphere as determined from the Rayleigh scattered laser light. Such data are of value to the Air Weather Service in support of strategic missile systems.

A design study will be carried out to investigate and provide solutions for problems related to the design of a laser radar system for measuring atmospheric densities at stratospheric altitudes. Ultimately hardware developed from this design study will be proposed for flight on the space shuttle system through the space test program. The laser radar system will measure atmospheric density by detection of the Rayleigh back-scattered signal produced by a laser transmitter.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

4.0022, NONLINEAR HUMAN OPERATOR MODEL IDENTIFICATION FROM OPERATING RECORDS
B.K. Colburn, Texas A & M University, College Station Campus, School of Engineering, Dept. of Electrical Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (DF055370; F49620-79-C-0091)

AF function - an important factor in the design of present and future military weapons delivery systems is the trade-off between machine (computer) control and human operator action. This is especially true of high performance Air Force jet aircraft such as the F-16. Deficiency - with the advent of control configured vehicles (CCV) digital fly-by-wire (DFBW) control systems, the flight/fire control task requirements of the pilot have increased significantly, requiring determination of the limits of pilot control. One way this can be accomplished is by obtaining validated human operator models which can provide prediction of the closed-loop flying qualities under stressed pilot control. Objective - whereas previous work by other investigators generally regarded the human as linear and time-invariant, the proposed research deals with use of the model reference adaptive systems (MRAS) approach to nonlinear operator model identification using only a single input (visual display)-single output (aircraft joy stick motion) type measurement signals. Based on previous work by the principal investigator on MRAS model identification it is proposed to apply the MRAS approach to nonlinear operator models based on operating records of man-in-the-loop simulations. How research contributes - results will provide insight as to the adequacy of the linear optimal control model for tracking tasks in CCV configured aircraft.

The general MRAS identifier will be implemented into a general simulator form in software suitable for processing recordings of specific pilot operating records obtainable at the Air Force Flight Dynamics Laboratory, and the existing program will be adapted into a flexible package that will allow inclusion of general nonlinearities. Parameterized nonlinear pilot models will be generated and results will be compared to those available from the optimal control model (OCM) approach using the same data. Results will be used to determine whether any nonlinear responses affect the resulting closed-loop (man plus machine) flying qualities, as well as whether the linear time invariant OCM is adequate for tracking tasks in new CCV configured aircraft. Results of computer data evaluation tasks requiring usage of digital computation will be in the form of human operator models for different operating records along with a comparison of the equivalent OCM.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0023, AIRCRAFT DIGITAL INPUT CONTROLLED HYDRAULIC ACTUATION & CONTROL SYSTEM
G. Raymond, Boeing Co., *7555 E. Marginal Way S., Seattle, Washington* 98124 (DF461320; F33615-77-C-2034)

The objective of this program is to establish and demonstrate hydraulic actuation system techniques that respond directly to digital input commands. The techniques will be applicable to continuous duty actuation functions such as air induction, engine inlet vanes, engine after-burner nozzles and flight controls.

A potential DEHA aircraft application will be selected aimed at establishing performance and design criteria. An analysis of promising advanced hydraulic actuation techniques implementing multimode electronic digital inputs, will be conducted to establish its applicability to future aircraft. Based on these results, a full scale DEHA prototype will be designed, fabricated and tested to verify compliance to performance and durability requirements.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0024, RESONANCE IN WEAKLY NONLINEAR SYSTEMS
J. Kevorkian, University of Washington, School of Engineering, Dept. of Aeronautics & Astronautics, *206 Guggenheim Hall, Seattle, Washington* 98105 (DF055900; F49620-79-C-0141)

AF function - aerospace vehicle stability. Opportunity - useful approximate analytic solution of certain nonlinear equations of motion seem attainable. Objective - a parametric understanding of phenomena involving resonance in weakly nonlinear systems. How work contributes -by improving design techniques.

The technique of multiple time (or space) scales, originated by Professor Kevorkian, is one of the most powerful ways to obtain uniform asymptotic expansions of differential and integral equations. It involves introducing slow and fast time variables to obtain a hierarchy of simpler equations for the expansion coefficients. It is proposed to attempt to extend the applicability of this technique to resonance phenomena for weakly nonlinear ordinary and partial differential systems with slowly varying parameters. Conditions for sustained resonance and the change in value of an adiabatic invariant across resonance are examples of topics to be considered.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0025, THE THERMAL CONDUCTIVITY OF OXYGEN FROM 1000 DEGREES K TO 4400 DEGREES K
H.N. Powell, University of Wisconsin, Madison Campus, School of Engineering, Dept. of Mechanical Engineering, *Madison, Wisconsin* 53706 (ENG78-22662)

The objective of this research is to develop further the method of shock perturbation for the measurement of the thermal conductivities of high temperature gases. This method is the only one yet developed which can be applied to diatomic and polyatomic species at temperature ranges where chemical dissociation and the activation of vibrational and electronic modes of energy storage become important. After further verifying the validity of the method, it is used to obtain the thermal conductivities of oxygen in the temperature range from 1000 degrees K to 4400 degrees K where depending on the pressure the gas may be up to 54 percent dissociated. The pressure range covered in the study is from 0.8 to 6 atmospheres.

SUPPORTED BY U.S. National Science Foundation, Div. of Engineering

4.0026, RECOMBINATION IN SOLAR CELL MATERIALS
P. Landsberg, University of Southampton, *Southampton, England, United Kingdom* (DF462090; AFOSR-77-3437)

Investigate, in detail, the theory and effects of multiphon emission-recombination and phonon assisted Auger recombination of minority carriers in solar cell semiconductor materials.

Review theoretical and experimental information on recombination in semiconductors. Develop multiphon and phonon assisted Auger recombination models correlate with known behavior. Correlate MP and PA Auger with phonon degradation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, ON THE KATABATIC WIND IN ANTARCTICA
G. Wendler, University of Alaska, College Campus, Geophysical Inst., *Bunnel Memorial Bldg., College, Alaska* 99735 (DPP77-26379)

Three automatic weather stations will be installed between Dome Charlie and Dumont D'Urville, Antarctica, during the austral summer of 1978/79. The meteorological data gathered by these stations during 1979 and 1980 will be used to investigate the katabatic wind phenomenon which is believed to strongly influence the climate of Antarctica.

Logistics support is required for one person during the austral summer of 1978/79.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0002, COLLABORATIVE RESEARCH ON PRE-SURGE CHANGES IN THE DYNAMICS OF A SURGE-TYPE GLACIER

W.D. Harrison, University of Alaska, College Campus, School of Mathematics, Dept. of Physics, *Bunnel Memorial Bldg., College, Alaska* 99735 (EAR76-22500 A01)

This is a continuation of research supported under NSF Grant EAR76-22463.

This project is a continuation of collaborative research between the University of Washington and the University of Alaska on the surge-type Variegated Glacier, St. Elias Mountains, Alaska. Studies will include continued monitoring on changes in surface elevation and velocity, extension of measurements of ice thicknesses by radio echo sounding, measurements of mass balance and winter velocity in firn area by means of buried magnetic markers, and initiation of time lapse photography of the glacier. Surface measurements will be used to estimate sliding velocity of the glacier and to pinpoint the initial location of fast motion preceding the next surge. Studies to date suggest that the next surge could be as early as 1981. Information on the dynamics of the glacier as the anticipated increases in velocity develop will be useful in understanding the causes for glacial surging.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0003, EXPERIMENTAL INVESTIGATION OF THE RELATIONSHIP BETWEEN ATMOSPHERIC ABSORPTION AND CLOUD NUCLEUS CONCENTRATION

S.A. Twomey, University of Arizona, Inst. of Atmospheric Physics, *Tucson, Arizona* 85721 (ATM77-11462)

Clouds are the main reflectors of incoming solar radiation and any influence of pollution on cloud reflectance has possible climatic importance. Theoretical studies indicate two opposing such influences -an increase in reflectance with pollution due to increasing drop concentration in clouds, and a decrease in reflectance with pollution due to increased absorption within the clouds. The present proposal proposes a measurement program in which simultaneous measurements of cloud-nucleating particles and bulk particulate absorption are to be made at a field site in Southern Arizona, following which the experimentally derived data will be applied in numerical computations of cloud reflectance and of the cloud contribution to planetary albedo.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0004, CHATANIKA ELECTRIC FIELD STUDIES

R.R. Vondrak, S R I International, *333 Ravenswood Ave., Menlo Park, California* 94025 (DF582310; F19628-79-C-0038)

AF function - satellite communication, navigation systems. Deficiency - inadequate knowledge of ambient electric fields causing effects which seriously degrade AF systems at high latitudes. Objective - to determine the electrodynamic state of the high latitude ionosphere. How research contributes - improve knowledge of physical processes affecting the high latitude ionosphere leading to realistic predictive models of ionospheric irregularities and circulating current systems.

Correlative data from the Chatanika incoherent scatter radar facility located at 65 degrees N latitude and the Air Force S3-2 satellite is analyzed and studied to determine the ambient electric field configuration, currents and height integrated conductivity in relation to ionospheric features such as diffuse aurora, discrete arcs and the plasma trough.

SUPPORTED BY U.S. Dept. of Defense, Air Force,
Geophysics Lab.

5.0005, INVESTIGATIONS OF PARTICLE BOMBARDMENT OF THE POLAR ATMOSPHERE

R.R. Brown, University of California, Berkeley Campus, School of Letters & Science, Dept. of Physics, *Berkeley, California* 94720 (ATM78-09366)

This grant is for further support of investigations of electron precipitation at high magnetic latitudes. These investigations will involve balloon flights carrying x-ray detectors from Sondre Stromfjord, Greenland (75 degrees magnetic latitude) in the summer months of 1979 and 1980 as well as studies of ionospheric absorption from electron precipitation using riometer data from high latitude sites.

The balloon flights will be conducted by the University of California, with the assistance and cooperation of Danish scientists from the Technical University of Denmark. The Danish group will provide supporting data from their extensive chain of riometers and magnetometers in Greenland. The balloon observations will be examined for temporal and spectral variations from electrons that originate deep in the magnetotail, during nighttime hours, and electrons precipitated from the cleft region during daytime hours.

The study of ionospheric absorption associated with electron precipitation events will be carried out at Berkeley using data from the riometer chain in Greenland as well as riometers established for the International Magnetospheric Study (IMS). Of particular interest in this study will be the role of the interplanetary magnetic field in controlling absorption events at sites in the cleft region.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0006, RIVER PROFILES AND DRAINAGE-BASIN GEOMORPHOLOGY

R.L. Shreve, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Geology, *405 Hilgard Ave., Los Angeles, California* 90024 (EAR76-22469 A01)

This research involves theoretical investigation of the development of river profiles and drainage basins in relation to the transported sediment supplied by the river beds and adjacent hill slopes. The empirical formulas that have been used to calculate such quantities as flow resistance, channelwidth, and sediment transport in a river will be refined by adding terms to reflect erosion in the channel network as a whole, relationships among different parts of the entire drainage system, and the non-uniform size of particles in the load. The evolution of river profiles will be calculated to show response to changes in such things as base level, sediment production, discharge, and gradient, as caused by tectonic activity or climatic fluctuations. Also investigated will be local features including arroyo cutting, terrace formation, and response to damming. The calculated development of profiles will be compared with attributes of known rivers and an analysis will be made of the concepts of local equilibrium and the graded river.

The study will attempt to refine mathematical treatments of river profile development that have been based on simplified assumptions and on empirical equations developed from observations of limited segments of drainage basins. The study should provide a useful approach for field studies of regional geomorphic history.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0007, PARTICLE PRECIPITATION EFFECTS ON THE MIDDLE ATMOSPHERE AND PALEOATMOSPHERE

S.V. Venkateswaran, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Atmospheric Science, *405 Hilgard Ave., Los Angeles, California* 90024 (ATM77-24843)

The objective of this research is to investigate the role played by energetic particle precipitation on the chemistry and dynamics of the stratosphere and mesosphere. Specific topics include: 1. identifying the mechanisms responsible for relativistic radiation belt electron precipitation and establishing their relative roles as ionizing energy sources for the upper atmosphere; 2. developing zonally averaged models for the mesospheric circulation which can be used to study atmospheric response to

various classes of precipitation; 3. investigating the paleomagnetic modification of the terrestrial ozone layer, particularly during periods of geomagnetic reversals; and 4. exploring potential mechanisms which may provide a causal link between solar or geomagnetic disturbances and the weather.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0008, CUMULUS CLOUDS, MESOSCALE CONVECTIVE SYSTEMS AND THEIR INTERACTIONS

W.R. Cotton, Colorado State University, School of Arts Humanities & Social Sciences, Dept. of Atmospheric Science, *Fort Collins, Colorado* 80523 (ATM76-83361 A01)

The South Park Area Cumulus Experiment (SPACE) is designed to study and describe cumulus clouds and their interactions with each other, the mesoscale, and the synoptic scale. The objective of the study is to use these data to develop a numerical simulation which accurately predicts the genesis, movement and precipitation intensity of cumulus cloud systems for given synoptic and mesoscale features. The numerical simulation should be suitable for use in improved prediction of cumulus and mesoscale weather phenomenon and to evaluate possible modification techniques for precipitation enhancement and severe storm abatement. The field experiment is located in South Park, Colorado, so as to utilize the cumulus genesis area created by the Mosquito Range located on the western boundary of the park and the large flat park to the east of the range to study the initiation and growth of clouds and their subsequent movement.

The field measurements program, to be conducted in summer of 1977, is model interactive and to date has made significant progress in understanding cloud initiation, cloud growth, cloud microphysics, and climatological aspects of cloud translation and propagation. This research would build on these studies with the primary focus of the research being the measurement, description, and the development of a data set from which models of cumulus scale and mesoscale interactions can be developed and verified.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0009, ARCTIC PROPAGATION ENVIRONMENT ANALYSIS

C.M. Rush, U.S. Dept. of Commerce, *Boulder, Colorado* (DF583350)

AF function - communications and detection. Deficiency - prediction and real time specification of the arctic ionosphere. Objective -provide a detailed a 4 dimensional, (3-D plus time) description of the ionospheric auroral environment.

An environmental data base existing at AFGL will be analyzed in a comprehensive case studies to enhance the understanding of the arctic propagation environment. The effort will be significantly enhanced during the OTH tests in FY80 and 81 with data input from 16 ground stations, several satellites and airborne experiments. The data will be analyzed to produce the best possible description of the ionospheric/auroral environment and of magnetic activity during the test periods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0010, GAMMA-RAY SPECTROMETRY IN URANIUM EXPLORATION

J.S. Duval, U.S. Dept. of the Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9790-01708)

STATES TO WHICH PROJECT PERTAINS: Texas, Wyoming, Washington, California, Arizona, Colorado.

During the current fiscal year we will be obtaining aerial gamma-ray data over seven small areas in the states of Washington, Wyoming, California, Arizona, and Colorado. A significant part of the fiscal year will be spent on the data reduction and interpretation of these data.

In a continuing effort to improve our use of the color images of the radiometric data we will be producing new images of high quality radiometric data in Texas and Wyoming. Some of the color manipulation techniques developed by Gary Raines of the U.S.G.S. will be applied in an attempt to remove some of the subjective aspects of the interpretation of the color images.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0011, AMBIENT AIR QUALITY SURVEY

K. Zeller, U.S. Environmental Protection Agency, *401 M St. S.W., Washington, District of Columbia* 20460 (DF407440)

To measure air quality levels near selected Air Force bases under a wide variety of meteorological conditions. Measurements will be used to (1) determine the local impact and compliance with Federal ambient air quality standards, and (2) to define accuracy limits for the computerized USAF/Argonne National Laboratory Air Quality Assessment Model (AQAM).

Study will be joint USAF/EPA/USN/FAA/DOE project, with EPA providing principal investigator. Phase I includes studies to determine optimum sampling locations, and a background investigation of atmospheric chemistry analytical techniques and of data acquisition and evaluation systems and techniques. Phase II includes performing ambient air quality measurements at Williams AFB, Arizona, utilizing five continuous monitoring stations. One complete year of acceptable data will be obtained. A second year of data collection is planned for a large naval air station. Measured data will then be compared with theoretical data predicted by the AQAM in project 19005A18.

SUPPORTED BY U.S. Dept. of Defense, Engineering & Services Center, Engineering & Services Lab.

5.0012, TRANSIENT SCATTERING BY HYDROMETEORS

J.J. Stephens, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Meteorology, *205 Wildwood Dr., Tallahassee, Florida* 32306 (ATM77-07758)

The objective of this research is the theoretical and computational examination of scattering of electromagnetic waves in the presence of various hydrometeors, mostly drops of ice and water. Though the complete solution for a sphere is available, its complexity thwarts a ready physical understanding of the diffraction process. It has been demonstrated by others that if the incident radiation is approximated by a (normalized) delta function then the scattered field of illumination is the impulse response. The latter description permits the isolation of several field contributions stemming from different interactions. This, in turn, permits a more direct physical interpretation than is otherwise possible. The primary application of these results is to the scattering signatures produced by meteorological radar.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0013, AEROSOL TRANSPORT OVER THE EQUATORIAL NORTH ATLANTIC OCEAN AS RELATED TO WEATHER, CLIMATE AND LAND USE IN NORTH AFRICA

J.M. Prospero, University of Miami, D.H. & Lewis Rosenstiel School of Marine & Atmospheric Sci., *4600 Rickenbacker Cswy., Miami, Florida* 33149 (ATM76-02198)

An aerosol collection and atmospheric turbidity network at six stations around the equatorial Atlantic is being established to collect and measure the aerosol output from North Africa. The objectives of this program are: (1) to identify the source areas of the mineral aerosol components, and the meteorological and climatological factions affecting their generation and transportation, (2) to determine if the increased aerosol output during the period 1968-1974 was derived from normally arid and/or desert

use practices by the continued long-term measuring of aerosol transport from North Africa during a period of reduced drought conditions; and (3) to measure the mass transport of mineral aerosols to the oceans.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0014, GLOBAL ATMOSPHERIC MEASUREMENTS EXPERIMENT ON TROPOSPHERIC AEROSOLS AND GASES (GAMETAG)

D.D. Davis, Georgia Inst. of Technology, School of Geophysical Sciences, *Atlanta, Georgia* 30332 (ATM76-81487 A02)

Using the NCAR (National Center for Atmospheric Research) Electra as a sampling platform, a global sampling effort will be initiated which will involve the measurement of over 50 atmospheric species and meteorological parameters on a simultaneous basis. Recognizing both the importance of chemically coupled atmospheric species and the strong interaction between chemistry and meteorology, the GAMETAG (Global Atmospheric Measurements Experiment on Tropospheric Aerosols and Gases) program is to be a joint effort among meteorologists, cloud physicists, and atmospheric chemists. Project GAMETAG calls for a seven-year project which is to be divided into two phases of two and five years duration. Phase I of the project, the objective of this grant, will have as its primary objective the elucidation of the importance of the hydroxyl free radical to tropospheric chemistry. In addition, there are two secondary objectives for Phase I: (1) an assessment of the global tropospheric budgets for halocarbons, ozone, and sulfur, carbon, and nitrogen species; and (2) a minor effort aimed at assessing the levels and types of natural tropospheric aerosols.

At least two major GAMETAG flights per year are scheduled. These flights, during the first two years of the program, are expected to span a global latitude range of 75 degrees N to 55 degrees S and a longitude range of 165 degrees to 30 degrees in the Western Hemisphere. The general sampling plan for GAMETAG will include representative transit flights into Polar, Tropical, and Transition air masses which have been modified both by continents and oceans and by large-scale ascent and descent.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0015, TECHNIQUES FOR PREDICTING OUTPUT FOR SPATIALLY VARIED WATERSHED SYSTEMS

D.L. Chery, U.S. Dept. of Agriculture, R.B. Russell Agricultural Research Center, *P.O. Box 5677, Athens, Georgia* 30604 (0045409; 7902-20810-004)

OBJECTIVE: Investigate techniques for making output predictions for large spatially varied watershed systems having different management practices and temporal inputs.

APPROACH: Test channel flow routine of a developed mathematical watershed model (WATSHED) with channel flow data from the SEA Little River watershed. Simple predictive mathematical models can be statistically fit to the response of a complex distributed watershed model or derived from specific input-output manipulations of the complex model. Further investigations of these strategies will be made. Enhance the watershed model (WATSHED) by including subsurface flow component. Parameters of watershed models may be quantified by remote sensing technologies, and the use of LANDSAT data in a prediction procedures for plant potential water demand within a watershed will be investigated. Assess watershed model prediction accuracy with respect to the needs and uses of such predictions.

SUPPORTED BY U.S. Dept. of Agriculture, Federal Research Office, Athens Georgia Area

5.0016, A DOPPLER RADAR/AIRCRAFT STUDY OF PLANETARY BOUNDARY LAYER GROWTH

P.H. Hildebrand, University of Illinois, Urbana Champaign Campus, Graduate School, *Urbana, Illinois* 61801 (ATM76-24236)

An experimental study of planetary boundary layer (PBL) growth dynamics is proposed. The experiment will use gust-probe equipped aircraft and Doppler radars to measure the temperature, humidity and air motion characteristics of the PBL several times a day on several days. The days will be chosen so as to minimize the disturbing effects of fronts or deep convection.

An aircraft will be used to drop radar signal reflecting chaff and to measure the means and fluctuations of temperature, humidity, and momentum as a function of height above ground. These data will be used to evaluate the turbulent energy balance equation for the PBL and to calculate the spectra, cospectra, and fluxes of heat, humidity and momentum. These calculations will be used to evaluate the relative importance of various sources and sinks of energy within the growing PBL. The results of currently existing numerical PBL models will be compared with this experiment.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0017, STATUS OF HARDWOOD REGENERATION IN INDIANA

P.E. Pope, Purdue University, Agricultural Experiment Station, McIntire Stennis Program, *Executive Bldg., West Lafayette, Indiana* 47907 (0073339; IND059045)

OBJECTIVE: Identify and map the forest resources for the State of Indiana with respect to location, forest type, physiographic region, soil type, and topographic position; determine the effect of site conditions and management practices in natural oak stands on the development of advanced oak regeneration; determine the effect of soil type, site condition and prior vegetation cover on the success of planted black walnut, yellow poplar and red oak seedlings.

APPROACH: The forest resource located on color IR LANDSAT images and classified by forest type, soil type and physiographic region. Once the resource is classified, the status of advanced natural oak reproduction will be determined for each major site-type classification with respect to associate species composition, density and position. Superimposed on this site-type classification will be four types of forest management. Planted hardwood seedlings are also important in reforestation. A survey of the hardwood plantings across the state will be conducted to determine the contribution of planted hardwoods to the future forest resources. Soil-site investigations should reveal the conditions most favorable for successful hardwood plantings.

PROGRESS: Preliminary data suggests that in natural oak stands with site index 70 or greater, advanced oak reproduction is (1) inadequate or absent in unmanaged stands and (2) sparse and inadequate in stands periodically thinned to not less than 60 m(2)/ha basal area. At present data are not adequate to evaluate advance oak reproduction in stands which have been burned or grazed. Survey of hardwood plantations indicated poor survival and slow growth on 70% of the sites investigated. Sites associated with successful plantations were characterized by deep but well-drained soils. Weed control was commonly practiced by the landowner. An attempt to discover the reasons for planting failure led to an investigation of new techniques for hardwood planting, including individually container grown seedlings, inoculation with mycorrhizae forming fungi, manipulation of seedling nutrition, and site preparation including chemical weed control. The project as initially described will be revised to reflect this new research emphasis. Presently studies are underway to determine the effects of container grown seedlings on survival and growth. (Text Abridged)

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Indiana

5.0018, PIEZOELECTRIC ACCELEROMETER FOR SPACE SHUTTLE TEST

D.H. Frykland, Accumetrics Corp., *Cambridge, Massachusetts* (DF583520; F19628-79-C-0095)

AF function - airborne surveillance, target acquisition. Deficiency - atmospheric density variations with time and space cannot be predicted with sufficient accuracy. Objective - direct measurement of atmospheric density by satellite-borne accelerometers. Correlation of these results is made with other satellite data and with solar-geophysical parameters to develop improved atmospheric models. How research contributes - permits accurate determination of Air Force satellite ephemerides and development of accurate density forecasting techniques.

A satellite triaxial piezoelectric accelerometer will be designed, fabricated, tested and calibrated. The instrument will be flown on one of the space transportation system orbital flight tests scheduled for flight in December 1979. The purpose of the instrument is to provide information on the orbital acceleration environment. In addition to monitoring the magnitude and frequency distribution of onboard generated accelerations, aero-dynamic drag effects will be measured. Atmospheric density is directly proportional to drag. NASA has modified the flight test timeline to turn the instrument on during periods of interest to AFGL.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0019, STRATOSPHERIC AEROSOL MEASUREMENTS

H.A. Miranda, Epsilon Lab. Inc., *Bedford, Massachusetts* 01730 (DF583610; F19628-79-C-0130)

AF function - environmental impact of stratospheric flight operations and optical propagations through the stratosphere such as surveillance, guidance, communications and target acquisition. Deficiency - information currently extant on aerosol particle distributions and employed as inputs by the modelling community may be grossly in error insofar as the stratosphere, and possibly even parts of the troposhere, is concerned. Objective - conduct two balloon-borne measurements of aerosol size distributions and altitude profiles to confirm the earlier initial measurements are accurate and do in fact represent a new, correct description of the aerosols. How research contributes - these measurements will definitely increase the confidence in the technique and provide sufficient new data to enable modellers to incorporate the aerosol results into AF models for environmental assessments and optical propagation studies.

The existing, unique, aerosol counter will be prepared for balloon flights to be launched from Holloman Air Force Base in April 1980. Specific flight profiles consisting of a rise to maximum altitude, descent to 60,000 ft., rise to maximum altitude followed by termination will be used to investigate possible balloon wake contamination and to obtain redundant altitude profiles for verification. The raw data is to be analyzed using the laboratory calibrations and the data presented in graphs and tabular format.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, DIFFUSION OF STRATOSPHERIC POLLUTION

J.L. Larson, Hycor Inc., *1 Gill St., Woburn, Massachusetts* 01801 (DF582730; F19628-79-C-0028)

Small frangible canisters are packaged into a dispensing system that can release smoke in a controlled manner a known distance below a balloon platform. The puff history, after release, is observed by TV and camera systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, INCOHERENT-SCATTER STUDIES AT MILLSTONE HILL DURING THE INTERNATIONAL MAGNETOSPHERE STUDY 1976-79

J.V. Evans, Massachusetts Inst. of Technology, Lincoln Lab., *244 Wood St., Lexington, Massachusetts* 02173 (ATM75-22193 A02)

This grant funds the operation of the Millstone Hill incoherent-scatter radar facility to conduct measurements and analyses of physical parameters of the upper atmosphere and ionosphere. Particular investigations being pursued include: 1. Detailed measurements of the temperature and wind structure in the lower thermosphere, to better understand tidal effects and temporal variations there. 2. Work with NASA combining the Millstone Hill data with NASA satellite data to develop a more accurate model of the atmosphere above 100 km. 3. Studies of dynamical processes in the atmosphere, including neutral winds, plasma diffusion along magnetic field lines, electric fields, and magnetic storms.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0022, WIND TUNNEL GERDIEN SHOCK WAVE STUDIES

M. Finston, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF582600; F19628-79-C-0059)

AF function - communication and radar survivability of Air Force systems such as AAB NCP, AWACS, BMEWS, OTH-B and DSP under naturally disturbed and nuclear environments. Deficiency or opportunity - total ion species concentrations are required to improve models that will predict VLF to VHF radar and communications propagation characteristics during quiet and disturbed atmospheric conditions. Objective - accurate calibration of rocket-borne Gerdien condensers used to measure total charge density. How research contributes - accurate total ion density measurements depend on careful calibration of the mass flow through the Gerdien condenser under simulated flight conditions. The Gerdien data together with the mass spectrometer relative ion species concentration data will be used to determine absolute ion species concentrations to be used for model inputs.

Calibration data on the Gerdien will be obtained using the Arnold Engineering Development Center 10 V chamber. Mass flow calibration and boundary layer growth along the vehicle will be studied at high density altitudes (70 km to 90 km) and Mach numbers from 3.0 to 3.5.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, LARGE-SCALE OSCILLATORY AND CONVECTIVE MOTIONS ON THE SUN

R.C. Altrock, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580780)

AF function - communications, surveillance, detection, tracking. Deficiency - inadequate knowledge of solar environment, disturbances, and physics limits ability to predict events which disrupt and degrade AF systems. Objective - to measure large-scale oscillatory (global pulsations) and convective (giant cells) motions on the solar surface and to develop theoretical models to explain these phenomena, which, if they exist, would provide information about the structure and behavior of the solar interior, and its influence on surface phenomena. How research contributes - several observations have suggested the existence of large-scale motions which have their origin deep within the sun. It is necessary to verify and provide more details of these motions and the resultant transfer of energy and magnetic fields from the interior to the surface, since theoreticians believe that these motions determine the nature of the solar activity cycle. Statistical fluctuations in this 22 year cycle probably determine the strength, lifetime, and frequency of hydromagnetic storms in individual active centers, which in turn cause the well-known solar induced environmental disturbances.

Observations made with the Sacramento Peak tower telescope diode array, echelle spectrograph, and universal birefringent filter, will be analyzed and compared with theoretical models developed under contract, to determine the nature of energy transport through the solar atmosphere, and the interac-

tion between magnetic fields and material motions, both in active sunspot centers and in quiet regions on the sun.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, AIR LAUNCHED BALLOON TECHNIQUES
A.S. Carten, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580610)

AF function - advanced balloon systems (surveillance, reconnaissance, communications, environmental research support). Deficiency or opportunity - present vehicles have limited altitude and payload capabilities. Objective - to develop an all weather operational lighter-than-air (LTA) vehicle or platform to put high altitude sensors and communications relays on station quickly and on short notice over battle theaters. How research contributes - this work involves in-house studies and investigations leading to the design, fabrication and test of an advanced prototype air-launched balloon system (ALBS). When the goals of this research are achieved it will be possible for the Air Force to deploy and inflate in mid-air, automatically and quickly, LTA platforms capable of supporting payloads of at least 200 lbs for 24 hours at altitudes of 70,000 ft or better. This capability will enhance the effectiveness of Air Force missions whose mode of operation requires the rapid availability of low cost substitute aerial platforms for communications relays like those presently carried on space satellite systems. TAC ROC 305-75 points up the need for such a substitute and specifically mentions LTA platforms.

The basic design configuration of the cryogenically-inflated ALBS has been worked out under IHWU 66651101, in which scientific balloons were chosen as the primary drop vehicles. Using data from that program, a more sophisticated, aircraft-oriented version of the system will be developed under IHWU 76591101 which will meet the stringent standards required of aircraft-borne equipment. To accomplish this goal the parachute system tested and refined during FY77 at the National Parachute Test Range will be adapted to the new hardened version of the ALBS and subjected to qualification tests at the NPTR in FY78-79. The ALBS balloon design will be modified as required to reflect any needed design improvements identified in the IHWU 66651101 test program. Also, the ALBS cryogenic gas storage and heat storage transfer unit used on that program will be redesigned by NBS, as a single dewar of the required capacity and a model of this design will be procured in FY78 for the planned test series. When the new aircraft-qualified system is assembled it will be launched early in FY80 over the WSMR at 25,000 ft. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, IONOSPHERIC MONITORING TECHNIQUE REFINEMENT
W.N. Hall, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580960)

AF function - communications, surveillance and navigation at high altitudes. Deficiency or opportunity - ground-based ionospheric and geophysical data inputs to the space environmental support system (SESS) are being squeezed by increasing costs and decreasing resources. Objective - to develop methods to transform remote ground-based ionospheric and geophysical measurements into forms suitable for convenient, automatic use by SESS and Air Force systems. How research contributes - automation of the functions of AF and contractor observers would reduce the cost of acquiring ground-based ionospheric and geophysical data inputs to SESS. Automation would counteract recent cost increases, prevent further loss of ground-based data sources, and increase the quantity and quality of ionospheric and geophysical data input to SESS.

The procedures used by the observers for reducing and reporting SESS data will be defined and analyzed. Analytical algorithms for automating the data reduction will be developed by computer simulation. The analytical algorithms will then be adapted for implementation in firmware in mini- or microcomputer systems. A SESS data communicator (SESSDAC) prototype will be developed under AFGL laboratory director's fund project ILIR8B. This will be a parallel effort to develop a hardware system for implementation of the analytical algorithms. The prototype will be applicable for use at all AWS sites reporting SESS data to AFGWC. The use of existing sensor systems, comm links, and data message formats will minimize the effort by AWS to utilize the automatically analyzed SESS data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, NORTHERN LATITUDE PLASMASPHERIC VARIABILITY
J.J. Klobuchar, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF580870)

AF function - time delays in satellite navigation detection and tracking systems. Deficiency - the day-to-day variability of the ionosphere and the unknown contribution of the plasmasphere are not adequately represented by current models which have errors of up to 25 percent RMS. The plasmasphere can contribute greatly to this variability. Objective - determine the variability of plasmaspheric electron content in the northern latitudes, its correlation for pairs of stations and the extent to which it can be predicted or associated with other geophysical parameters. How research contributes - the contribution of the plasmasphere to total time delay produced on satellite radar and navigation systems can be large. The unknown behavior of the day-to-day variability of the total time delay is the greatest remaining error source in models of range error used by ADCOM in satellite detection radars and in the single frequency mode of the NAVSTAR/GPS satellite navigation system.

Using data already available from three northern mid-latitude stations, and additional data to be taken at a station near the peak of the equatorial anomaly, the day to day variability of the plasmaspheric electron content will be examined to determine the correlation between pairs of stations. Comparisons will also be made with other geophysical parameters to attempt to find the source of this variability from monthly average behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, HF RECEIVER AND TRANSMITTER DEVELOPMENT
H. Laping, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582780)

AF function - advance balloon systems for surveillance, reconnaissance, communications telemetry, command, environmental research. Deficiency - the existing equipment was designed in the early 60's. Reliability and age was starting to become a problem. Objective -design, develop and flight test an HF command receiver and data transmitter incorporating the latest solid state devices and modern filter technique. These components will be included in a standard balloon control instrument package to enhance reliability and system power source uniformity. How research contributes - with a standard flight control system that has been advanced to the state-of-the-art, the current need for special control systems on many of the balloon research flights will be reduced or eliminated. This will result in both dollar and manpower savings. The use of an HF command and data system is not limited to line of sight balloon flights.

A dual channel, dual conversion, narrow bandwidth HF command receiver incorporating the latest integrated circuits and transistors will be designed, bread-boarded and tested in-house by AFGL personnel. Also, an 8 watt HF data transmitter meeting all FCC specifications will be designed, bread-boarded and tested in-house. The transmitter will be able to withstand any voltage standing wave ratio with stable frequency output. In conjunction with the transmitter a matching network will be designed to transform the antenna impedances to 50 ohms so that the transmitter can be used with any length of 50 ohm coaxial cable and tedious tune-up procedures will be eliminated. From the in-house design, final flight models will be developed and tested under contract. The final units will be integrated into a standard balloon flight instrument and flight tested by AFGL

personnel. A technical report will be the end product of the IHWU.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, FEASIBILITY OF AUTOMATING TACTICAL WEATHER OBSERVATIONS

E. Moroz, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583000)

AF function - launch and recovery of aircraft in tactical environment. Deficiency - AF lacks capability to obtain meteorological measurements important to tactical air operations and to automate them. Objective - to investigate application of meteorological sensors for tactical operations and to determine the feasibility of automating standard tactical AF weather observing equipment. How development contributes - investigation will provide an assessment of the potential for automating tactical weather information.

The availability of instruments and techniques for determining weather parameters such as visibility and cloud height for AF tactical operations will be determined. Methods of automating the operation of standard tactical weather equipment such as the AN/TMQ-15-wind measuring set, AN/TMQ-20-temperature/humidity measuring system and the Army's remote automatic weather system (RAWS) will be investigated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0029, DETERMINATION OF STRATOSPHERIC WINDS AND TURBULENCE AS A FUNCTION OF LATITUDE USING PHOTOS OF SMOKE TRAILS

A.F. Quesada, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF581160)

AF function - to gain quantitative understanding of stratospheric dynamics needed to predict environmental effects of AF aircraft and missile operations in and through the stratosphere. Deficiency -reliable prediction of emission effects from supersonic aircraft and missile operations is not available due to paucity of measurements of parameters that determine transport processes in the stratosphere. Objective - to measure parameters that characterize stratospheric dynamics in order to develop models that will accurately predict dispersal rates and residence times of materials injected into the stratosphere. How research contributes - will provide the data to define and model transport mechanisms.

Photographic observations of upper atmosphere or stratospheric smoke releases provide data relevant to the physical state and motion of the stratosphere or lower thermosphere. Of special interest are smoke trail positions, drifts, and growth, from which ambient winds, wind shears and divergences are determined by photographic triangulation. The results of these studies provide improved physical models of the atmosphere in the natural and disturbed state, as well as data on winds, wind shears and turbulence at supersonic aircraft operating altitudes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, STATISTICAL ATMOSPHERIC OPTICAL MODELS AND WEATHER

E.P. Shettle, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583110)

AF function - reconnaissance, communications, surveillance, guidance, target acquisition and tracking. Deficiency - the performance of any electrooptical system looking through the atmosphere is significantly degraded by atmospheric light scattering and absorption. Therefore, it is dependent in a complex way on the variability of the state of the atmosphere in the theater of operation. Objective - develop operational models of the atmospheric effects on the propagation of optical/IR radiation, especially the properties of the atmospheric particulates, and the scattering properties of the atmosphere. How research contributes - development of such models of the atmospheric aerosol properties will lead to an improved ability to model and predict the effects of the atmosphere on the performance of E/O systems. Examples of such effects include the modeling of the slant path contrast reduction which limits the operational capability of precision guided munitions, or predicting the probability of detecting laser systems from off-axis scattering of the laser beam.

Develop or update models of the atmospheric aerosol optical properties based on such inputs as the experimental efforts under this project (7670), and the analysis and correlation studies carried out under CWU 762111AF. These new models will include an optical climatology of Europe and statistical characterization of the properties of atmospheric aerosols and their relation to meteorological conditions. The models will be refined for use in optical propagation programs such as LOWTRAN or the contrast transmission computer codes. These models with the propagation codes can be used to derive nomograms or analytic expressions for the prediction of atmospheric effects on E/O systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0031, SCATHA LOW ENERGY PLASMA ANALYSIS

M. Smiddy, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF583230)

AF function - surveillance, communication, navigation and spacecraft charging. Deficiency - inadequate knowledge of the electrical properties of the magnetosphere and of the interaction of a satellite with the environmental plasma at synchronous altitudes. Objective - to determine the role of low energy particles in spacecraft charging at synchronous altitudes. How research contributes - permits improved military space vehicle design for communication and surveillance systems. Provides understanding of dynamical processes in the magnetosphere and contributes to the understanding and solution of spacecraft charging problems.

The data from low energy sensors flown aboard the SCATHA, P78-2 satellite will be analyzed and synthesized to distinguish the major sources of low energy particle flow to, and from the vehicle. The effects that ion/electron gun operation and spacecraft eclipse conditions have on the vehicle potential will be determined. Special coordinated studies will be carried out to investigate current flow and vehicle charging in disturbed conditions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0032, ATMOSPHERIC RESPONSE TO LATITUDINAL VARIATION OF TURBULENCE

S.P. Zimmerman, U.S. Dept. of Defense, Air Force, Geophysics Lab., *L.G. Hanscom Field, Bedford, Massachusetts* 01731 (DF582860)

AF function - communications, satellite surveillance and satellite orbit prediction. Deficiency - inadequate knowledge of the upper atmosphere, particularly its response to natural and man-made disturbances. Objective - to measure turbulent transfer coefficients in the atmosphere and to develop improved theoretical neutralionic model atmospheres. How research contributes - following solar proton events and nuclear detonations, radio communications are interrupted and missiles and satellites are lost from radar view. Improved models that can predict ionospheric perturbation effects can aid in the improvement of communications and tracking of vehicles. Improved models of the neutral atmosphere will result in more accurate predictions of system satellite ephemerides.

The latitudinal variation of measured turbulence, in conjunction with atmospheric pressure gradients and gravitational forces, controls the behavior of the mean mass motion in the thermosphere. This in turn affects the in situ variations of the neutral constituents as well as the ionic species which are also controlled by the earth's magnetic field. To examine the atmospheric response to these stimuli and to other perturbations such ion turbulence, a three-dimensional model of the structure and dynamics of the mesosphere and thermosphere will be developed. Concurrent with this effort, an existing one-dimensional neutral ionic atmospheric model will be used to examine ther-

mospheric effects of turbulence over northern latitudes and over the equator.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0033, THE ASSEMBLY AND CATALOGING OF MICHIGAN RESOURCE DEVELOPMENT DATA

W.J. Kimball, Michigan State University, School of Natural Resources, Dept. of Resource Development, *323 Natural Resources Bldg., East Lansing, Michigan* 48824 (0059362; MICL01093)

OBJECTIVE: Identify appropriate resource planning and development procedures for Michigan; assemble and catalog pertinent Michigan land use information along with other information relating to resource situations and uses, and conduct a pilot project which will explore the potential use of remote sensing data as a guide for land use analysis and planning.

APPROACH: Data assembled in 1966 on county and district land use patterns in Michigan will be updated. Multiple-sensing prints for Sumpter township in Wayne County (available at the Willow Run Laboratories) will be analyzed and the findings will be used for land use planning purposes. Emphasis also will be given to the continued assembly, cataloging and development of Michigan resource development data.

PROGRESS: Numerous units of state government were contacted for new data toward updating the County and Regional Factbooks. Cooperative arrangements were completed with the Michigan Office of Intergovernmental Relations for updating the three Michigan Upper Pennisula regional factbooks. Exploration is underway for further county and regional data assembly and distribution possibilities. Various personnel involved in this project and two other related Department of Resource Development research projects are considering combining the three in a general project which might be titled "Developmental Data for Local and Regional Decision Making.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative Research Office, Michigan

5.0034, NAVY ENVIRONMENT - SIMULATIONS OF OCEANOGRAPHIC FLUCTUATIONS IN THE NORTH PACIFIC OCEAN

S. Jacobs, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (DN223750; N00014-76-C-0141)

Large-scale long-term variability in the temperature structure of the upper ocean has a pronounced effect on acoustic propagation conditions and hence on our surveillance systems. The objective of this project is to develop a dynamic ocean model using numerical techniques which will simulate and forecast the sea surface temperature, transport, and surface heat balance resulting from large scale atmospheric heat flux anomalies in the North Pacific Ocean. This project is an integral part of the North Pacific Experiment (NORPAX).

Because observed atmospheric data are used to 'drive' the ocean forecasting model, it is necessary to compile, analyze, and condense appropriate information such as solar radiation, humidity, air-sea temperature differences, surface winds, etc. The ocean forecasting model itself utilizes fundamental hydrodynamic principles and is programmed for a computer. Because observed oceanic data is used to test the model, it is necessary to compile appropriate information.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0035, THE FORMATION, MAINTENANCE, AND CLIMATIC EFFECTS OF WEST COAST SEA STRATUS

J.W. Telford, University of Nevada, System Office, Desert Research Inst., Atmospheric Sciences Center, *Reno, Nevada* 89507 (ATM77-16321)

The objective of this research is to use an instrumented aircraft to gather cloud microphysical properties and radiative fluxes of stratus clouds so as to examine in detail the latest models and thinking related to the formation and persistence of ocean stratus and fog.

Special emphasis will be made on the role of radiation and cloud top mixing processes on the development and persistence of these clouds.

During the initial stages of this program, the efforts will be primarily to install, calibrate, and test the performance of cloud physics and radiation instruments aboard the DRI research aircraft.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0036, AN INVESTIGATION OF ELECTRIC FIELDS IN THE TIME-DEPENDENT MAGNETOTAIL

C.H. Murphy, Kean College of New Jersey, Graduate School, Dept. of Earth & Planetary Environment, *Morris Ave., Union, New Jersey* 07083 (ATM76-11763)

The research supported here is an extension of work carried out under NSF Grant ATM75-17342#1. The objective of the research is to obtain a clearer understanding of the temporal behavior of the electric field in the earth's magnetotail. Of special interest is the induced electric field and its relationship to electric fields produced by charge separation.

It is recognized that the magnetotail is a composite of several different modes of current conduction, and the role of the electric field in driving these currents varies. Hence, the temporal behavior of the electric field may well be different in the various regions of the magnetotail.

This work proposes to study the major current modes in the tail and solve them for the time-dependent case. Previous work on a simple neutral sheet model has added considerable insight to this approach. All systems will be solved self-consistently so that neither the induced or charge separation components of the electric field will be ignored.

After the separate elements of the tail current system have been studied, it will be necessary to tie them together in a reasonable fashion to simulate to total tail current. This synthesis will be done in the context of a model that will allow the variation of the electric field in the tail to be related to conditions external to the magnetosphere, i.e., solar influences.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0037, SOME DYNAMIC AND RADIATIVE EFFECTS OF THE SAHARAN AIR LAYER - A CONCLUSION

T.N. Carlson, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Meteorology, *116 Deike Bldg., University Park, Pennsylvania* 16802 (ATM76-14518 A01)

The objective of this research is to complete a project that studied the effect on the atmosphere of Saharan dust outbreaks during the GARP Atlantic Tropical Experiment (GATE). The first and completed phase of this project was devoted to an analysis of solar radiation and aerosol measurements, a determination of the radiative properties of the aerosol, and a description of the large scale aerosol mass loading during several Saharan dust outbreaks using satellite visible brightness measurements. In this final phase the net (solar and infrared) aerosol heating rates will be estimated. The balanced vertical motions will be computed, both with and without radiative forcing, from large-scale wind analyses for three case studies in order to describe the effects of the Saharan air layer and dust on the overall dynamics of the tropical atmosphere.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

5.0038, NAVY ENVIRONMENT - RADIANCE AND POLARIZATION OF LIGHT IN THE OCEAN

G.N. Plass, Texas A & M Research Foundation, Dept. of Oceanography, *Faculty Exchange Box H, College Station, Texas* 77843 (DN123231; N00014-75-C-0537)

Optical systems designed for remote sensing and surveillance, submarine detection and communication, search recovery operations, and sea floor inspection requirements are all critically dependent on a thorough understanding of the optical properties of sea water and the nature of the background illumination in the ocean. This task will examine and model the radiance and polarization of light in the ocean.

Monte Carlo and matrix operator techniques are used to calculate theoretical models of photon interactions from natural sunlight and artificial sources for coupled atmosphere-ocean systems. Scattering and absorption by aerosols, hydrosols, atmospheric and water molecules; reflection and refraction at the atmosphere-water surface; surface wave effects; and polarization effect are all included in the numerical models. These calculations predict the effect of wavelength solar angle, hydrosol size, and ocean waves on the distribution of the intensity and polarization of light in the ocean.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0039, FRONTS AND CYCLOGENESIS OVER THE GULF OF MEXICO
W.K. Henry, Texas A & M University, College Station Campus, School of Geosciences, Dept. of Meteorology, *College Station, Texas* 77843 (ATM76-22282)

The major objective of this research is the compilation of a synoptic climatology of fronts for the Gulf of Mexico. Such a compilation, drawing upon data from North, Central and South America, would provide an improved formulation of synoptic events in the Gulf. Particular emphasis will be given to type of front, distributions of observed cloud and weather, the existence and nature of cyclogenesis, and the return flow problem. The results are expected to make a contribution to both synoptic meteorology and weather forecasting.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0040, THE LATITUDINAL DISTRIBUTION OF IONOSPHERIC ABSORPTION
H.J. Chivers, Utah Higher Education System, Utah State University, Graduate School, *Main Bldg., Room 132, Logan, Utah* 84321 (ATM76-17762)

This grant will support a program of analysis of the data from the latitudinal chain of riometers to be operated in Alaska during the period of the International Magnetospheric Study (IMS). This network of stations already exists in a primitive form and is about to be expanded to higher latitudes with improved instrumentation so that high-quality digital records will be obtained. Since the new riometers which will be used will have a fast response time, emphasis will be placed on the analysis of the fine structure of auroral absorption events. Recent studies of absorption events recorded with the Alaskan chain have shown that there are probably two significant components to each absorption event. These components tend to move at different velocities in the latitudinal direction, and, in fact, the components have been observed to move in opposite directions. These movements can be related to corresponding movements in the magnetosphere following solar disturbances and the movements have been used to derive a value for the electric field of the magnetosphere. The main result expected will be to show to what extent the short period variations of absorption take part in the complex latitudinal motion of absorption. In addition, a class of fast isolated events associated with relativistic electron precipitation has been identified, and these can be used in conjunction with observations using the Chatanika radar facility to investigate magnetosphere dynamics. This award represents a small but important part of the coordinated activities to be performed under the IMS.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0041, RESEARCH IN ANTARCTIC METEOROLOGY
W. Schwerdtfeger, University of Wisconsin, Madison Campus, School of Letters & Science, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DPP77-04506 A02)

This project is a continuation of NSF Grant Number DPP 7704506. It involves research into four aspects of the synoptic meteorology of Antarctica, using historical data, present-day U.S. and foreign synoptic observation, and satellite measurements. The research will focus initially on the tropospheric moisture transport into East Antarctica and on the atmospheric driving forces of the Weddell Sea gyre, then continuing into an investigation of strong terrain-induced surface winds and cold-air jets in the atmospheric boundary layer. No logistics support required since no field work will be done.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

5.0042, OPERATE GOOSE BAY IONOSPHERIC OBSERVATORY
J. Kelley, Canadian Commercial Corp., *Hull, Quebec, Canada* (DF582450; F19628-79-C-0035)

AF function - Air Weather Service (Military Airlift Command) space environmental support system (SESS). Communications, surveillance, and navigation at high latitudes. Deficiency - natural disturbance in ionosphere and upper atmosphere which affect AF systems are inadequately known. Real time input data essential to SESS. Objective - operate and maintain the Goose Bay Ionospheric Observatory (GBIO). Analyze SESS data and report to Global Weather Central (AFGWC). How research contributes -the research data provided by the contractor to AFGL is essential in understanding ionospheric, magnetospheric, and upper atmospheric processes which impact existing and proposed AF and other defense systems. Real time SESS input data is essential to AWS support of SESS customers. GBIO data will be used in the systems performance test of the 4141 over-the-horizon experimental radar system (ERS).

The contractor provides technical personnel to operate and maintain ionospheric vertical and backscatter digital ionosondes, magnetometers, riometers, radio polarimeters, and satellite signal monitoring systems. Data analysis reduce real time ionospheric and geophysical data and report these data to AFGWC for SESS. GBIO will be used to evaluate methods and systems for automation of the analysis and reporting of SESS data. An ionogram communicator will be installed to transmit digital ionograms in real time to the 4141 ERS receive/operations site in Maine.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, OAS DISPLAY SIMULATION
P. Narveson, Sperry Rand Corp., *P.O. Box 2529, Phoenix, Arizona* 85002 (DF325440; F33615-79-C-0524)

This contract will develop simulated offensive avionics system (OAS) display formats. These are necessary to perform an evaluation of the phase I OAS controls and displays proposed for the avionics update to the B-52G/H in response to SAC-ROC 6-75.

A programmable display generator system (PDGS) was obtained from Sperry Flight Systems through Boeing Wichita Company under a previous contract. This hardware is an upgrade to hardware now being used by Boeing for similar simulations and is architecturally comparable to the radar scan converter and display electronics unit being designed for the aircraft. The Boeing software will be modified (because the instructions sets are different on their PDGS vs. AMRL's) and extended (to include additional formats not needed by Boeing that are required for Phase I OAS evaluation).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0002, MAN/MACHINE INTERFACE MODEL
H.R. Jex, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DF325150; F33615-79-C-0519)

Vibration environments encountered in some aircraft mission profiles can seriously degrade the performance of essential aircrew tasks. The amount of degradation in performance is influenced by the manner in which the crewman is interfaced with his controls and displays. The objective of this contract is to provide designers with the tools for optimally selecting seatback angles, display viewing angles and distance, arm rest and control stick arrangements, and other interface variables so as to minimize the deleterious effects of vibration on task performance such as tracking and aiming.

The approach under this contract is to utilize computer modeling and display techniques to determine what would otherwise require expensive and time consuming experimentation with a variety of cockpit mock-up configurations on complex vibration facilities. The contractor will deliver a user-oriented computer programming package that will demonstrate such interface optimization methods.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0003, DEVELOPMENT OF DESIGN CRITERIA FOR RAPID PRE-EJECTION CREW RESTRAINT
L.J. Specker, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF322370)

Injuries resulting from exposure to aerodynamic forces during emergency escape using open ejection seats are a major problem. The solution requires both ejection seat stability and limb restraint and both are interrelated, i.e., the lack of one will aggravate the other. The restraint system must provide complete protection during escape but not encumber the crewmen during normal flight and thus compromise the mission. Furthermore, in multiplace aircraft restraint must be quickly and automatically applied on pilot command to properly preposition and protect crewmen who are not prepared to eject. The objective of this research is to define design criteria for mechanisms which will automatically position and restrain crewmen in an optimum body posture for safe emergency escape. The criteria will include minimum actuation times, maximum retraction forces and velocities, and body segment restraint sequencing timing.

Experiments will be conducted using a special test fixture consisting of an ejection seat mockup and a system of hydraulically actuated devices which can independently or sequentially retract shoulder straps, lap belt arm restraint, and leg restraint. Volunteer subjects will be automatically restrained utilizing varying initial body positions and retraction speeds. Retraction force-time histories, impact forces and body segment accelerations and trajectories will be measured during each test. Data collected during these tests will be studied using a mathematical model of the human body, the restraint system, and the retraction device. The mathematical analysis will permit a parametric analysis of the restraint system design criteria and prediction of injury modes as well as performance of the protection system under adverse flight conditions. The resulting design criteria and analysis will be provided to the aeronautical systems division for incorporation into system development specifications and the AFSC design handbook series.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0004, ADVANCED DISPLAY CONCEPTS
H.L. Task, U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF325530)

This work unit will examine recently evolved technology for potential application to new display approaches that take advantage of reduced weight, improved form factor, increased field-of-view or any of the myriad of such factors as can contribute to improving the interface of displayed information to the operator. The effort is partially aimed at establishing techniques that can be applied by ASD to the development of an operational helmet mounted display (HMD) in the post-1980 time frame. Efforts will be directed toward exploitation of advanced technology. Specific emphasis will be placed upon alternatives to panel mounted displays for the cockpit environment.

A comprehensive technical survey will be made to include fiber optics, image conduits, various image sources and any other promising technologies that appear applicable. Laboratory work will be conducted to examine the utility of selected survey results.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

6.0005, SELECTION FOR NAVIGATOR TRAINING
H.E. Jensen, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF234220)

Identification of characteristics of superior navigators in operational roles, investigation of experimental cognitive and non-cognitive measures, the recommendation of improvements in the UNT screening battery.

Newly revised navigator training program will be reviewed. Approximately 300 UNT candidates will be administered a battery of psychomotor, perceptual, and information processing tests as well as the AFOQT. These measures will be examined in light of subjects' performance in UNT, CCTS, and in an operational role. Exit interviews will be conducted with those who are dismissed from either UNT or CCTS and aircraft assignment preferences will be examined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0006, DEVELOPMENT OF A READING ABILITIES TEST FOR AF PERSONNEL
J.J. Mathews, U.S. Dept. of Defense, Air Force, Human Resources Lab., *Brooks Air Force Base, San Antonio, Texas* 78235 (DF232980)

To develop, validate and norm two forms of a standardized diagnostic reading/comprehension test. The target population will include enlisted, officer, and civilian AF personnel. The test will be cross-referenced with several commercial instruments. The stability of reading skill improvements overtime will be assessed. This work, in part, supports an AF/DA program to make Air Force publications more comprehensible.

Technically-oriented, multiple-choice test items will be developed and pre-tested. Separate scales for comprehension, vocabulary, and interpretation or generalization will be devised. Two levels of the test may be needed to cover the range of abilities in the population. One would be a high school version with a reading grade level (RGL) average of about 11 and a range of 4 to 14. This would be appropriate for most enlisted personnel. A college version would have an average RGL of about 14 and a range of 9 to 17. This would be appropriate for measuring officers' RGLs. Initial RGL estimates of enlisted personnel will be based on commercial tests and ASVAB scores. Preliminary data will also be obtained for officers on a commercial test. The AF reading test developed will be validated against technical training and officer training programs. Norms will be developed from cross-sections of enlisted, officer, and DAF civilian personnel. Reading evaluations will be performed for BMT remedial reading classes and comparisons will be made between RGLA of airmen in BMT and at two and four year points of initial service. Milestones - reading test item development, 1 Apr 77 to 1 Nov 77, obtaining commercial tests, 1 May 77 to 1 Oct 77, testing on commerical tests, 1 Oct 77 to 1 Jan 78, AF test assembly and printing, 1 Oct 77 to 1 May 78, commercial test-ASVAB analysis, 1 Jan 78 to 1 Mar 78, draft first tech report, 15 Feb 78 to 1 May 78, AF test validation, 1 May 78 to 1 Dec 78, AF test norming, 1 May 78 to 1 Apr 79, BMT reading evaluation, 1 Jan 78 to 1 Mar 79, 2 yr, 4 yr reading evaluation 1 Jun 78 to 1 May 79, draft final tech report 1 Mar 79 to 1 Sep 79.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0007, CONDUCT FIELD VALIDATION OF NOISEMAP

P. Oncley, Man Acoustics & Noise Inc., *Seattle, Washington* 98103 (DF324650; F33615-79-C-0513)

NOISEMAP is the computerized noise prediction procedure that forms the cornerstone of the USAF air installation compatible use zone (AICUZ) program. The AICUZ program is used by the Air Force to bed down new weapons systems, select facility sites, evaluate existing operations and determine the land use compatibilities of all USAF bases with the neighboring communities. The objective of this contract is to further assess through long-term field measurements the overall ability of NOISEMAP to predict the yearly averaged noise environments produced by aircraft operations for the wide variety of missions and airbase locations within the Air Force as a whole. In cases of extreme controversy or litigation over environmental assessments for AF operations, these long-term field measurements will provide further evidence of the ability of NOISEMAP to predict the noise environments from AF operations.

This contract is to conduct long-term field measurements of total noise exposure at several locations around one or two USAF bases and compare these measured values with those predicted by NOISEMAP. This effort will be accomplished as follows: (1) the contractor shall develop a written plan delineating the exact number, location and schedule of rationale for each, (2) this plan will be submitted to AMRL for review and final written approval before any measurements are made, (3) the contractor will conduct the long-term measurements of total noise exposure and analyze the field data in accordance with the approved plan, (4) the contractor will submit a final report presenting the acquired data, comparisons with the NOISEMAP predicted values and final conclusions about NOISEMAP's overall effectiveness.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Lab.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, THE DYNAMICS OF GRAVITATING SYSTEMS

C. Hunter, State University System of Florida, Florida State University, School of Arts & Sciences, Dept. of Mathematics, *205 Wildwood Dr., Tallahassee, Florida* 32306 (MCS77-28148)

Continuation of MCS-7506177. This research deals with five problem areas concerning the dynamics of galaxies: 1) calculating large scale modes of oscillation of disc galaxies, 2) the stability of galaxies, 3) the underlying structure of galaxies, and the significance of approximate integrals of motion, 4) a re-examination of the bending of otherwise flat galaxies, and 5) the dynamics of the process of fragmentation by which groups of stars may be formed.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Mathematical & Computer Sciences

7.0002, CLIMATIC DATA COMPACTION AND RETRIEVAL

P.N. Somerville, State University System of Florida, University of Central Florida, School of Arts & Sciences, Dept. of Mathematical Sciences, *P.O. Box 25000, Orlando, Florida* 32816 (DF248890; F19628-77-C-0080)

AF function - support weather sensitive Air Force and Army missions. Deficiency - current military mission planning requires a more expeditious recall of basic climatic probabilities than is presently available. Development - apply statistical theory and computer methods to the climatic records. How development contributes - will contribute to a military capability to expeditiously assess the climatic influence on a mission and avoid underestimations of risk of operation anywhere worldwide.

The approach is statistical, to adapt analytical models and algorithmic computer methods, so that they can be used to compress historical records of weather events. Retrieval of information is made in probability terms. Weather elements to be investigated will include ceiling, visibility, winds and precipitation.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, EXPERIMENTAL AND THEORETICAL STUDIES OF LATTICE DYNAMICS

J.B. Page, Arizona State University, School of Liberal Arts, Dept. of Physics, *Tempe, Arizona* 85281 (DMR77-06809 A01)

Continuation of research supported by DMR 75-10414.

The research proposed consists of a number of experimental and theoretical projects in the following four areas: (1) High-pressure Brillouin scattering studies of molecular crystals, particularly the disordered-partially ordered phase transitions in KCN and NaCN. (2) Correlation spectroscopy studies on biological systems, concentrating on diffusion of macromolecules, reorientation phenomena of lattice defects possessing electric and elastic dipoles, and elementary excitations in an analog of the Wigner crystals. (3) Theoretical studies of the anharmonic properties of very low frequency impurity-induced phonon resonances. The initial concern will be anharmonic effects on defect-host coupling and isotopic frequency shifts. Effects of temperature, applied stresses and applied electric fields will then be studied. An investigation of defect-induced ferroelectric phase transitions will also be made. (4) Impurity-induced resonance Raman scattering. The general theory of resonance Raman scattering from impurities having strongly phonon-broadened electronic absorption bands will be studied with respect to the validity of the Born-Oppenheimer and Condon approximations. Ab initio calculations of F center electron-phonon coupling coefficients will be carried out and used as a basis for calculating K band, L band and multi-phonon contributions to the Raman spectra. Studies will also be made of resonance Raman scattering from systems having well-resolved vibronic structure in the optical absorption bands.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0002, EXPERIMENTAL OSCILLATOR STRENGTHS IN HIGHLY IONIZED ATOMS

S. Bashkin, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (PHY78-09138)

This grant will support an experimental program in atomic physics research at the University of Arizona. The proposed experiments involve determination of experimental oscillator strengths (transition probabilities) of the lowest-lying n equals O transitions in highly-charged ions with one or two electrons outside closed shells. The particular ions to be studied are: Li-like Kr plus 33 and Rh plus 42, Be-like Kr plus 32 and Rh plus 41, Cu-like Br plus 6 and Kr plus 7, and Zn-like Br plus 5 and Kr plus 6. The oscillator strengths will be obtained from beam-foil mean-like and wavelength measurements performed at the University of Arizona Van de Graaff Laboratory and at the University of California Lawrence Berkeley Laboratory Super-HILAC. The purpose of these experiments is to provide data to test fundamental theory: 1) general calculational technique in the case of the Cu- and Zn-like systems and 2) accurate relativistic calculations of atomic wave functions in the case of the three and four electron systems. In the latter case, relativistic effects play a major role rather than constituting a small perturbation. Further, the scientific measurements proposed are of immediate, direct interest in both astrophysical studies (solar flares) and the controlled thermonuclear fusion program.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0003, EXPERIMENTAL RELATIVITY BY DAYTIME ASTROMETRY AT SCLERA
H.A. Hill, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (PHY77-08200 A01)

Research will continue on measurements of the low-frequency solar oscillations discovered recently, and on the definition of the sun's edge. In parallel, the daytime tracking of stars and planets will continue, to determine the gravitational deflection of light passing close to the sun.

This work is a continuation of that currently supported under NSF grant PHY75-11190 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0004, PROPERTIES OF CONDUCTION ELECTRONS IN METALS
R.W. Stark, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (DMR77-03683 A01)

This research program will be directed to experimental studies of lifetimes and Fermi surface effects for electronic transport in pure or nearly pure metals. The first of these studies relates to experiments on electron quantum states having very long quantum state lifetime in magnesium. The now well understood electron quantum interference effect in magnesium will be used to measure the effect of electron-electron and electron-phonon scattering on the quantum state lifetime. Also, this effect will be used to investigate alloy effects in the concentration (C) range of 0.1 ppm less than C less than 20 ppm. Another ramification of the very long quantum state lifetime for electrons in pure magnesium which will be investigated is Pippard's magnetic band structure generated by magnetic breakdown for critical directions of the magnetic field. The second principal area of research centers around measurements of the de Hass-van Alphen effect in ferromagnetic nickel. The basic measurements of the de Haas-van Alphen spectrum for nickel will be completed in order to determine the complete Fermi surface. Also, the effective cyclotron masses will be determined on this surface. This latter data will be used to determine the two spin densities-of-states for nickel as well as obtain information about the many-body electron magnon renormalization effects.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0005, CONFIGURATION-DEPENDENT PROPERTIES OF POLYMERIC CHAINS
P.J. Flory, Stanford University, School of Humanities & Sciences, Dept. of Physics, *Stanford, California* 94305 (DMR76-20638 A02)

This study falls in the general area of configurational statistics of chain molecules. This is a renewal of NSF Grant DMR73-07655. The focus has shifted somewhat from the treatment of characteristics such as the average mean square distance (R2) and the average square of the radius of gyration (S2) that represent the long polymeric chain as a whole to properties having a more local character. The study might be divided into three parts.

Part I of the study concerns the formation of cyclic molecules from acyclic chains. The peculiar dependence of the cyclization tendency on ring size has long been known and experimental results are available on a number of systems. Explanations will be sought for the conformation characteristics of the acyclic chain sequence and in the statistical probability that the ends of the sequence meet in a conformation with their terminal bonds in acceptable mutual orientation.

Part II comprises investigations of optical anisotropy -depolarized light scattering, electric birefringence and strain birefringence - of oligomers and polymers. These methods are sensitive to conformation and to stereochemical structure.

Part III will explore the use of synchrotron X-radiation, uniquely available in high intensity at the Stanford Synchrotron Radiation Facility, for small-angle scattering studies on polymer solutions. Initial work will be directed at the intermediate range of scattering wave vectors, (4 pi over lambda) sin (theta over 2) equals 0.01 to 0.5, suitable for probing correlations between relatively short sequences of the chain.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0006, LINEAR AND NONLINEAR OPTICAL EFFECTS IN LIQUID CRYSTALS
Y.R. Shen, University of California, Berkeley Campus, School of Engineering, Dept. of Physics, *Berkeley, California* 94720 (DMR78-18826)

Lasers are devices capable of producing extremely high intensity pulses or beams of light. Some lasers can produce pulses so intense that they are capable of melting steel or of other effects called 'second order effects'. Liquid crystals, on the other hand, have extraordinary electrical and optical properties, as evidenced in their use as temperature indicators (a small change in temperature produces a change in color) and as LCD (liquid crystal display) devices (where an electric field changes the optical properties). The thrust of Professor Shen's work is to examine the interaction between the very intense fields generated by laser light and the liquid crystals. The extent of interaction can be subtly varied by changing the temperature of, or static fields appled to, the liquid crystals, facilitating obtaining information on both liquid crystals and the nature of interactions with very intense light.

Research, supported under DMR 76-19843, on linear and nonlinear optical effects in liquid crystals is being continued with a new set of experiments involving stimulated Raman and Brillouin scattering, wavelength dispersion of optical-field-induced ordering, self-focusing in active medium, second harmonic generation, optical-field-induced transitions, and/or alloying effects. The results should give a better understanding of properties of liquid crystals, of the general features of various nonlinear optical effects, of the characteristics of phase transitions, and of impurity and alloying effects on materials.

This is a continuation of work supported by DMR76-19843. It is the first year of a 3-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0007, ELECTRONIC STRUCTURE AT INTERFACES
S. Schultz, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DMR77-22781 A01)

This experimental research program is a continuation and extension of work initiated under grant DMR-7424361. Experiments will be done to further our understanding of electron spin dynamics in metals using the microwave transmission technique as a probe of the interface properties of metals. A new long-term project in semiconductor-related research will be initiated. The initial experiments are designed to study the spin transport and electronic properties of the metal semiconductor interface over a broad range of semiconducting properties. Particular attention will be paid to the high dopant regime which yields ohmic contacts. Basic experiments relating to the interface properties of a photovoltaic cell will also be investigated.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0008, NONLINEAR MIXING SPECTROSCOPY OF CONDENSED MEDIA
M.D. Levenson, University of Southern California, School of Letters Arts & Sciences, Dept. of Physics, *3551 University Ave., Los Angeles, California* 90007 (DMR77-11326 A01)

The experimental investigations of the nonlinear optical properties of condensed matter previously supported by NSF grant DMR-7614881 will be further developed and extended in new directions. The three-frequency coherent Raman spectrometer will be upgraded and its unique capabilities exploited to extract the signatures characteristic of specific physical processes while rejecting the artifacts generally present in the coherent anti-Stokes (CARS) technique and the Raman-induced Kerr

effect (RIKES) technique. Topics for detailed study include: resonance effects in the Raman and electronic contributions to the nonlinear susceptibility tensor; relaxation effects in inhomogeneously broadened one- and two-photon electronic transitions on the picosecond and sub-picosecond time scale; and spatial dispersion in the effective third-order nonlinear susceptibility tensors in crystals lacking a center of inversion symmetry and in other systems in the region of a phase transition.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, NMR STUDY OF AN ADSORBED GAS SYSTEM

R.J. Rollefson, Wesleyan University, School of Liberal Arts & Sciences, Dept. of Physics, *Middletown, Connecticut* 06457 (DMR74-23110 A01)

This is a continuation of work funded under DMR74-23110. An NMR study will be made of adsorbed 3He films on highly uniform substrates of MgO. The range of temperature and coverage will be extended. Adsorbate dynamics will be examined in the various phases and in transitions between phases.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0010, RELATIVISTIC AND EXCHANGE EFFECTS IN NONMETALLIC COMPOUNDS

D.E. Ellis, Northwestern University, Evanston Campus, School of Arts & Sciences, Dept. of Physics & Chemistry, *633 Clark St., Evanston, Illinois* 60201 (DMR77-22646)

The relativistic Dirac-Slater one-electron theory will be generalized to include exchange polarization of open shell systems in a self-consistent framework. This theory will provide a simple unified treatment of spin-orbit and orbital polarization effects. Computational methods, which have been developed for atoms and molecules, will be applied to study the energy levels, charge and magnetization densities for nonmetallic compounds of the heavy transition metals and rare earths. The theoretical results will be compared with Mossbauer isomer shift and hyperfine data, photoelectron spectra, and neutron magnetic form factors.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0011, EXPERIMENTAL STUDIES OF MAGNETIC AND DENSITY WAVE INSTABILITIES

P.M. Horn, University of Chicago, School of Physical Sciences, Dept. of Physics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (DMR78-20601)

Experiments will be carried out on a number of systems which undergo magnetic and density wave instabilities. Some one-dimensional magnetic chain compounds will be examined by x-ray scattering techniques to look for a 'Spin Peierls' transition in which the magnon-phonon interaction gives rise to a density wave. X-ray scattering experiments will also be used to study the liquid-solid phase diagram for adsorbed monolayers of krypton and xenon on graphite surfaces. The results will be compared with the predictions of well-known two dimensional models.

Specific heat and magnetic susceptibility experiments will be carried out on iron chloride-cobalt chloride mixtures to examine critical point instabilities. Iron chloride is an antiferromagnet with spins which point along the crystalline c-axis while in cobalt chloride, the spins lie in the plane perpendicular to the c-axis.

This is a renewal of work previously supported by DMR 7514360, the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0012, SYNCHROTRON RADIATION STUDIES OF IMPURITIES INTERACTING WITH METALS

C.P. Flynn, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DMR77-27942)

A dual beam differential absorption apparatus will be built to make efficient use of large photon fluxes available from synchrotron storage rings in the study of the properties of materials. Initial research applications of the new equipment will be concerned with impurities interacting with metals. Impurities in metals, on metal surfaces, and at interfaces between two materials will be investigated. The photon absorption will reveal phenomena associated with chemical shifts of core levels, crystal field splitting of atomic states in the material, and the response of the electron liquid to the excited center. These areas have strong relevance to alloy properties, chemical catalysis by material surfaces and to adhesion phenomena.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0013, THE CEPHEID AND RR LYRAE DISTANCE SCALES - A COLLABORATIVE INVESTIGATION BY PURDUE U. AND THE U. TEXAS AT AUSTIN (ABBREV)

T.J. Moffett, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (AST76-20841 A01)

A new method will be used to calibrate the classical cepheid distance scale and the period-luminosity relation. Simultaneous photometric and spectroscopic observations will be made of these variable stars. The photometry will be used to determine the variation in angular diameter with phase. The spectroscopic and photometric measurements will be used to give the distance and the mean linear radius of each variable. A similar program will be carried out on the RR-Lyrae variable stars.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

8.0014, NEAR-RESONANT CHARGE TRANSFER IN HIGHLY EXCITED ATOMS

K.B. MacAdam, University of Kentucky, College of Arts & Sciences, Dept. of Physics & Astronomy, *Limestone & Euclid, Lexington, Kentucky* 40506 (PHY78-00923)

This new project in atomic physics will study the charge-transfer interactions between highly excited sodium atoms and helium atoms. In this project in the study of atomic collisions, experiments on near resonant charge transfer in high excited (Rydberg) atoms will be performed. Atomic sodium, selectively excited by lasers to high-lying s or d states, will form the target for bombardment by He plus ions in the energy 100-5000 eV. Helium atoms, neutralized into correspondingly high-lying Rydberg states by charge transfer, would be analyzed by field ionization and optical methods. Cross sections would be studied as a function of initial- and final-state principal and angular-momentum quantum numbers, beam energy, and energy defect, with the experimental method allowing considerable freedom to select these parameters at will. The results would have implications for energy transfer in lasers and plasma and for astrophysical studies of hot galactic regions.

This is the first 12 months of a 2-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0015, MOLECULAR BEAM EPITAXY FOR TERNARY SEMICONDUCTOR DEVICES

A.H. Clark, University of Maine, Orono Campus, School of Arts & Sciences, Dept. of Physics & Astronomy, *36 Winslow Hall, Orono, Maine* 04473 (ENG76-14393 A02)

This program is concerned with the use of molecular beam epitaxy (MBE) for fabrication of ternary semiconductor devices. Initial efforts are on films of CuInSe2 on bulk substrates of the same material. Continuing efforts will concentrate on: (1) pro-

duction of materials and devices by homo-epitaxy of CuInSe2 and CuInTe2, (2) hetero-epitaxy of CuInSe2 on CdS, and (3) controlled growth of poly-crystalline CuInSe2 and CuInTe2 on various substrates.

Films are characterized in situ using electron diffraction and Auger analysis. In addition, resistivity, Hall effect, photoconductivity, optical constants, and photoluminescence are studied on materials and devices produced by MBE system.

This is a continuation of research previously supported under NSF grant ENG-7614393.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

8.0016, PHOTOPRODUCTION OF PIONS FROM COMPLEX NUCLEI

E.C. Booth, Boston University, School of Liberal Arts, Dept. of Physics, *755 Commonwealth Ave., Boston, Massachusetts* 02215 (PHY77-14903)

A program of meson photoproduction studies will be continued at the MIT Bates Electron Linear Accelerator, in collaboration with scientists from MIT and other institutions. (a) Coherent, threshold-region neutral pion production total cross sections will be measured to investigate the reaction mechanism and the interaction between the produced pion and the residual nucleus. (b) The photoproduction of charged and neutral pions and of protons will be studied with moderate energy resolution in the region of the 3-3 resonance. (c) The above studies will be extended, subject to detailed design and feasibility studies, to high-resolution studies of neutral photo pion angular distributions and to a study of the energy dependence of multiparticle production. This work is a continuation of that performed under Foundation grant PHY76-15850.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0017, INDUCED FLUORESCENCE MICROSCOPY WITH COLLIMATED PROTON BEAMS

P. Horowitz, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Physics, *Cambridge Station, Cambridge, Massachusetts* 02138 (PCM77-09376 A02)

It is proposed to continue studies with, and development of, the scanning 2 MeV external proton-beam microprobe. Briefly, the technique is capable of generating two-dimensional maps of the distribution of selected elements, even at trace concentrations, in a sample maintained in air or in a special environmental state, e.g. frozen and hydrated. Improvements include: a) sophisticated data collection allowing background subtraction, b) employing electromagnetic beam focussing for higher intensity and resolution, c) adding simultaneous high-resolution optical microscopy, d) employing wavelength-dispersive detectors (in addition to the present energy-dispersive detector) for improved performance in the low atomic number domain, and e) construction of a flexible frozen specimen chamber, for continuation of our kidney studies. It is proposed to apply the microprobe, as its capabilities continue to improve, to studies of kidney function, occupational toxins, living tissues, enzyme localization, the role of zinc in sperm maturation and neurological disorders.

SUPPORTED BY U.S. National Science Foundation, Directorate for Biological Behavioral & Social Sciences, Div. of Physiology Cellular & Molecular Biology

8.0018, GRAPHITE INTERCALATION COMPOUNDS AND THE ELECTRONIC STRUCTURE OF GRAPHITE

M.S. Dresselhaus, Massachusetts Inst. of Technology, School of Engineering, Dept. of Electrical Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-10858)

This program will be a continuation of research on the electronic properties of intercalated graphite compounds, a class of materials with very high electrical conductivities - approaching that of copper. The objective will be to understand the high conductivity in terms of the electronic structure and microstructure. Compounds will be prepared by intercalation with alkali metal donors and halogen acceptors.

The electronic structure will be studied using the magnetoreflection technique to obtain quantitative information on: (1) the electronic levels for the interior graphite layers, (2) the carrier density in the interior graphite layers, and (3) the effective mass of mobile carriers. Infrared spectroscopy, x-ray diffraction and electron microscopy techniques will be used to determine chemical composition and to study the microstructure of the intercalated compounds.

This research will be a continuation of studies initiated under NSF Grant DMR76-12226.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0019, LUMINESCENCE STUDIES OF DEFECTS IN LONE-PAIR SEMICONDUCTORS

M. Kastner, Massachusetts Inst. of Technology, School of Science, Dept. of Physics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DMR78-00836)

The models of Anderson, of Street and Mott, and of Kastner, Adler and Fritzsche explain qualitatively many of the electronic and optical properties of chalcogenide amorphous semiconductors. In particular, luminescence and related experiments seem to indicate well-defined defects in glasses which have the property that electrons on these defects possess a negative effective correlation energy because of strong electron-photon interaction. However, recent experiments indicate that a widely accepted model of the luminescence mechanism is inadequate. For example, Hudgens and Kastner, utilizing a new experimental technique, fatigue spectroscopy, showed that neutral excitations diffuse large distances in chalcogenide glasses. Experiments are underway to study the spatial diffusion and energy transfer processes in chalcogenide glasses. When combined with work on time-dependent spectroscopy of the luminescence, funded separately, a deeper and more quantitative picture of the luminescence and luminescence fatigue processes will emerge. Special attention is given to the structure of the defects involved in luminescence and fatigue, and development of experiments to demonstrate directly the sign of the effective correlation energy.

This is a continuation of work supported by DMR 76-11972. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0020, EXPERIMENTAL NUCLEAR SCIENCE

F.D. Becchetti, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Physics, *Ann Arbor, Michigan* 48104 (PHY78-07754)

An experimental program to investigate clustering phenomena in nuclei with direct transfer reactions will be carried out at a number of accelerator facilities. These data will provide quantitative tests of current theoretical models of nuclear clustering. Related work involving nucleosynthesis and nuclear stability will also be done.

This work represents a continuation of that currently supported under Foundation grant PHY76-00287.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0021, STRONG INTERACTIONS WITHIN THE FRAMEWORK OF THE TOPOLOGICAL EXPANSION

C.E. Jones, University of Nebraska, Lincoln Campus, School of Arts & Sciences, Dept. of Physics, *Lincoln, Nebraska* 68508 (PHY78-09619)

Research will be done in theoretical physics to further our understanding of the elementary particles. The research program will study the properties of the strong interactions and their relation to a fundamental quark structure. The basis for this study will be the so-called Topological Expansion (TE) of scattering amplitudes. Such an expansion gives successive ap-

proximations to unitarity depicted as diagrams with increasingly complex topologies. The first approximation in the TE is the planar amplitude, in terms of which all the higher topological contributions are constructed. Within the context of this technique, several specific projects will be carried out.

This work is a continuation of that currently supported under NSF grant PHY-7614438 A01.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0022, PROPERTIES OF DISORDERED MATERIALS AND PHASE TRANSITIONS

P.L. Leath, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DMR78-10813)

Theoretical research in condensed matter physics will be carried out. The main emphasis will be on calculations of the properties of disordered materials and phase transitions. The topics to be investigated include: (1) The critical behavior of dilute magnets at percolation threshhold. These calculations will be extended from two dimensions, where they have not yet been tried. (2) The nature of clusters in the percolation problem with short range order will be studied, because of their importance to real disordered materials. (3) The formation of energy band tails in the density of states of highly disordered materials. Previous Monte Carlo sampling studies have shown that 'ramified' (i.e., branch-like) clusters occur with greater probability than compact ones. The question of whether these clusters play an important role in energy band tails will be examined.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0023, STATISTICAL MECHANICS

J.L. Lebowitz, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Physics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (PHY78-15920)

Research in theoretical physics supported under NSF grant PHY77-22302 will be continued on a broad program of basic research in statistical mechanics of equilibrium and non-equilibrium phenomena. Particular emphasis will be given to the study of phase transitions in equilibrium systems and of stationary non-equilibrium states carrying currents, e.g., a steady heat flux.

Another area of interest is the so called 'transition from regular to irregular behavior' in dynamical systems. This phenomenon appears to be a general characteristic of a large class of non-linear systems occurring both in Hamiltonian and in (forced) dissipative systems. It has relevance in the first case to problems in chemical kinetics and various types of accelerators and in the latter case to fluid turbulence.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0024, MEASUREMENTS OF FORBIDDEN REFLECTIONS IN GERMANIUM AND SILICON USING SYNCHROTRON RADIATION

B.W. Batterman, Cornell University, Ithaca Campus, School of Engineering, Dept. of Materials Science, *242 Carpenter Hall, Ithaca, New York* 14853 (DMR78-11636)

X-rays scattered by bonding electrons in diamond, silicon and germanium will be used to determine the spatial distribution of these bonding electrons. These experiments are of interest to many in solid state physics who are concerned with the detailed electronic behavior and location in these semiconductors. X-rays are reflected from crystals in certain well defined directions which are determined by the lattice spacing, the x-ray wave length and the direction of the incident x-ray beam. Some reflections are forbidden by the atomic arrangements in the crystal, but are weakly allowed because of the asymmetric distribution of charge about the atoms and due to the anharmonic motion of the core electrons about their equilibrium position. Observations of these forbidden electrons can lead to a much more precise determination of the electronic spatial distribution in the bonds between atoms. These results can be compared to the calculated charge distributions. Synchrotron radiation from the Cornell Electron Storage Ring (CESR) will be used as an x-ray source for this experiment and will make considerable improvement in experimental accuracy possible.

This is a continuation of the research supported by DMR-7302384.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, STRUCTURE OF DISORDERED SYSTEMS DETERMINED BY FREQUENCY DERIVATIVE X-RAY DIFFRACTION

N.J. Seeschik, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Physics, *Stony Brook, New York* 11790 (DMR77-28542)

Standard X-ray diffraction techniques will be extended by the development of frequency modulation x-ray diffraction methods. This will add the dimension of elemental tunability–the ability to observe the contributions of a particular element to the scattering of the x-rays. The ability to observe a particular element arises from the fact that near the characteristic absorption edge of that element, the derivative of the scattered x-ray intensity with respect to the x-ray frequency is dominated by the interference of x-rays about that element. The Fourier transforms of such derivative data yield directly the radial distribution of neighboring atoms about that element. This method will be applied to the study of amorphous materials to demonstrate the potentials and limitations of the technique.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0026, THERMOELECTRIC EFFECTS IN METALS AND ALLOYS

P.L. Taylor, Case Western Reserve University, Graduate School, Dept. of Physics, *2040 Adelbert Rd., Cleveland, Ohio* 44106 (DMR78-22461)

Research previously supported by DMR7602368.

A theoretical study will be undertaken on the thermoelectric properties of metals and alloys, with emphasis on the behavior of simple metals at low temperatures. The thermoelectric coefficients are sensitive to a number of scattering effects whose influence is not felt in other transport properties, and so the relative importance of a variety of these many-body effects on the Seebeck coefficient will be studied. Initially some previous calculations of the consequences of the electron-phonon interaction will be extended within the framework of a simple model of an isotropic metal. Following these model studies a computer calculation will be undertaken of a more realistic set of systems, in which anisotropy will be included, and to which applied magnetic fields may be added. The first metals to be studied numerically will be the cubic crystals potassium and aluminum. Potassium is of interest in that some controversy attends the interpretation of many of its transport properties; aluminum is an appropriate choice for investigation among the polyvalent metals in that its wave functions and band structure have already received extensive study.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0027, SECONDARY FERROIC CRYSTALS

R.E. Newnham, Pennsylvania State University, University Park Campus, School of Earth & Mineral Science, Dept. of Geosciences, *116 Deike Bldg., University Park, Pennsylvania* 16802 (DMR74-21596 A01)

This research will be a fundamental study aimed at understanding secondary ferroic switching in quartz. The ferroic (twinning) studies will concentrate on ferrobielastic and ferroelastoelectric switching. Static measurements will include deter-

mination of the nature of the coercive stress in a ferrobielastic and determination of the nature of ferroelastoelectric switching. Kinetics of switching will be studied by correlated visual, acoustic and electric observations. Some effort will be directed toward studying switching under stresses thermally induced by laser heating the surface of crystals. These basic studies will be of benefit to the design of devices such as electromechanical filters, transducers, and frequency controllers.

This is a renewal of NSF Grant DMR74-21596.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0028, TRANSPORT AND THERMODYNAMIC PROPERTIES OF MAGNETIC AND NEARLY MAGNETIC SYSTEMS

T.W. Mihalisin, Temple University, School of Liberal Arts, Dept. of Physics, *Broad St. & Montgomery Ave., Philadelphia, Pennsylvania* 19122 (DMR76-16433 A02)

In most metals and alloys, the arrangement of atoms about each other has a profound effect on the magnetic and electronic properties of the material. The connection between the atomic arrangement and the physical properties of the material is the basis for much of solid state physics. This research will use transport and thermodynamic measurements to systematically investigate the role of crystalline electronic fields, the Kondo effect, valence fluctuations, magnetic order and spin fluctuations in a number of rare earth intermetallic compounds and alloys. Many of these effects are present simultaneously in the same material and must be sorted out in order to interpret the interesting properties near magnetic critical temperatures. A variety of experimental techniques will be employed including specific heat, thermal expansion, magnetization, resistivity, thermal conductivity and ultrasonic attenuation.

This research was previously supported under DMR-7616433.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0029, CRITICAL PHENOMENA AND PHASE TRANSITIONS

D.M. Jasnow, University of Pittsburgh, School of Arts & Sciences, Dept. of Physics & Astronomy, *4200 5th Ave., Pittsburgh, Pennsylvania* 15260 (DMR76-19443 A01)

Research previously supported by DMR76-19443.

Theoretical research in condensed matter physics will be carried out. Among the problems to be investigated will be the application of renormalization techniques to non-uniform systems. This will include the evaluation of the order parameter profile between two coexisting phases, in order to examine the nature of the interface separating the phases.

Also, problems in the area of polymer dynamics will be studied. For example, the question of the interplay between 'excluded volume' forces and hydrodynamic interactions will be studied, in order to determine the spectrum of relaxation times for a polymer in a solvent.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0030, HIGH-FREQUENCY ULTRASONIC WAVE AND PHONON PROPAGATION IN DIELECTRICS

C. Elbaum, Brown University, Graduate School, Dept. of Physics, *University Hall, Box 1883, Providence, Rhode Island* 02912 (DMR77-12249 A01)

This research was previously supported by DMR75-14761.

Research on phonon propagation and scattering in condensed matter will be carried out. The investigation will be in four areas: (1) Kapitza resistance: the heat pulse technique will be used to measure the reflection coefficient of phonons incident on an interface between silicon and solid helium at high pressure. Microscopic calculations of phonon transmission across interface will be performed for a number of simplified models of the surface region. (2) Accurate measurements of the velocity of roton second sound will be made in order to understand roton-roton interactions. (3) The mechanical and ultrasonic properties of solid helium will be studied by deforming it plastically in unconstrained shear. These deformation experiments will be followed by studies, using ultrasonic means, of the subsequent evolution of crystal defect behavior. (4) The propagation of ultrasonic waves in metallic glasses at low temperatures will be investigated and subsequently their thermal and electrical properties. Special emphasis will be directed to understanding the differences in the ultrasonic response of these glasses as compared with that of insulating glasses as well as crystalline metals and dielectrics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0031, MILLIKELVIN STUDIES OF SOLID HELIUM-3 MAGNETIC EFFECTS AND SUPERCONDUCTING AMORPHOUS TRANSITION METALS

W.P. Kirk, Texas A & M University, College Station Campus, School of Science, Dept. of Physics, *College Station, Texas* 77843 (DMR78-10808)

An experimental study will be made at low temperature of the unusual magnetic and nuclear spin ordering effects in solid helium-3. Nuclear magnetic resonance techniques will be used to obtain more accurate measurements of the magnetic susceptibility at various molar volumes. The magnetic properties of solid helium-3 will be studied at interfaces of magnetic materials. The use of submillikelvin cooling techniques and nuclear magnetic resonance techniques will be extended to the study of amorphous transition metals. These studies are important to the clarification of the behavior of quantum solids and to understanding the properties of metallic glasses.

This is a continuation of work funded under DMR76-09807.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0032, INVESTIGATION OF ELECTRON PRECIPITATION ASSOCIATED WITH VLF ACTIVITY AT SIPLE STATION, ANTARCTICA

W.R. Sheldon, University of Houston, School of Arts & Sciences, Dept. of Physics, *3801 Cullen Blvd., Houston, Texas* 77004 (DPP76-22135 A01)

Four SuperArcas rockets will be launched from Siple Station, Antarctica, during the austral summer of 1978-79 as part of an intensive study of magnetospheric wave-particle interactions taking place at Siple during that period.

The SuperArcas rocket payload, an X-ray flux experiment, will be parachute deployed near 85 km altitude, providing approximately 15 minutes of data above 30 km. The X-ray measurements will provide flux and spectra information about electrons precipitation as a result of very-low-frequency wave-particle interactions. These measurements will be correlated with those made from balloons (at 30 km), Nike-Tomahawk rockets (at 150-250 km), and ground-based detectors.

Logistics support for four scientists at Siple Station during austral summer 1978/79.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

8.0033, TOPICS IN THE PHYSICS OF FLUIDS - PHASE TRANSITIONS TO A STATE OF LOWER SYMMETRY

J.B. Swift, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (DMR7611426A01)

Research previously supported by DMR 76-11426. The research will be primarily concerned with the problem of dynamical phenomena near phase transitions to states displaying spatial structure. Several problems having to do with this topic will be investigated, including dynamics near the nematic-smectic-C transition of a liquid crystal and dynamics near the Lifshitz

point of a liquid crystal. Also the dynamics near the paramagnetic helicoidal transition in isotropic models of magnetic systems, and acoustic attenuation near a critical point, will be studied.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0034, DYNAMICAL INSTABILITIES AND THE TRANSITION TO TURBULENCE IN CLASSICAL AND QUANTUM FLUID FLOWS

H.L. Swinney, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Physics, *200 W. 21st St., Austin, Texas* 78712 (DMR78-10779)

This is a continuation of research previously supported by NSF grant DMR-7611033.

Time-dependent instabilities and the transition to turbulence will be investigated experimentally in two systems: a classical fluid contained between concentric cylinders with the inner cylinder rotating, and a quantum fluid, superfluid helium. The latter system will be studied for two configurations, thermal, counterflow, where the normal and superfluid components flow in opposite directions, and superfluid flow, where the normal fluid is at rest. These experiments will be performed in a new laser light scattering laboratory to be established at the University of Texas at Austin. In both experiments the temporal and spatial dependence of the local velocity in the fluids will be measured by the technique of laser Doppler velocimetry. Computer records of the velocity data will be Fourier-transformed to obtain velocity power spectra, and these data will be complemented by flow visualization photographic studies. The measurements in helium will provide the first local probe of turbulence in a quantum fluid. The proposed experiments on both systems should lead to new insights into time-dependent instabilities and should stimulate and guide new theoretical developments.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0035, INTERACTING EXCITATIONS IN CONDENSED MATTER

J. Ruvalds, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR77-13167 A01)

Research previously supported by DMR-72-02972.

Theoretical research on interacting excitations in various phases of condensed matter will be carried out. The following topics will be emphasized: (1) Quantum Liquids: The strong hybridization the He3 quasi particles with the phonon-roton branch in He3-He4 mixtures will be calculated. Also the effective He3-He4 coupling will be computed in search of the possible formation of a new superfluid phase in the mixtures. (2) Plasmon Excitations: Plasmon lifetimes in metals will be calculated and recent plasmon anomalies observed in electron loss measurements will be investigated. (3) Phonon Coupling and Phase Transitions: The connection between phonon coupling and certain structural phase instabilities will be considered with emphasis on metal hydrides which exhibit unusual superconducting properties. Of primary concern will be the role of anharmonicity in the phonon softening and its relation to the observed superconductivity at high temperatures.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0036, STRUCTURE OF PHYSICALLY ADSORBED LAYERS

S.C. Fain, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (DMR77-26931)

Rare gas overlayers adsorbed on graphite are under investigation in a number of laboratories as model systems for the study of phase transitions and critical phenomena in quasi two-dimensional systems. Lower dimensional systems are important for testing theories of critical phenomena and cooperative phenomena in condensed matter. The structure of physically adsorbed monolayers and multilayers on solid-state surfaces will be studied by high-resolution, low-current, low-energy electron diffraction (LEED). The orientational epitaxy of out-of-registry Ar monolayers on graphite and the substrate-overlayer distance of in-registry Kr monolayers on graphite will be studied. These results will permit direct tests of theoretical models of solid monolayers physically adsorbed on the basal plane of graphite single-crystals. An improved LEED-Auger apparatus for higher-resolution LEED and coverage measurements at lower temperatures will be built for use in these experimental studies.

This research was previously supported under DMR-7422168.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0037, TRICRITICAL PHENOMENA AND STATISTICAL MECHANICS

E.K. Riedel, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (DMR77-12676 A01)

Research begun under NSF Grant No. DMR 76-01070 will be continued and extended. Theoretical studies on the statistical mechanics of phase transitions and critical phenomena will be undertaken. Two types of problems will be studied in this general area: 1) scaling field approach to critical phenomena, and 2) model calculations. The scaling field research will be concerned with the completion of work on the basic formalism, the development and perfection of the calculational techniques, and tests through applications to specific systems. Model calculations will be performed for 1) phase transitions in quasi-two-dimensional systems, 2) percolation and critical phase transitions in systems with random defects, and 3) the structure of the interface between ordered phases.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0038, MOLECULAR ADSORPTION AND SURFACE REACTIONS, COMBINING INFRARED REFLECTION-ADSORPTION SPECTROSCOPY WITH OTHER SURFACE TECHNIQUES

R.G. Greenler, University of Wisconsin, Milwaukee Campus, School of Letters & Science, Dept. of Physics, *Pearse Hall, Room 107, Milwaukee, Wisconsin* 53201 (DMR76-82937 A01)

Infrared spectroscopy is used by the Principal Investigator as a tool for investigating the nature of molecular adsorption and reactions that take place on metal surfaces. The method of reflection-adsorption spectroscopy has been developed to the point where it can give measurable infrared bands from only a few percent of an adsorbed monolayer of CO (carbon monoxide). This technique is combined, in the same ultra-high vacuum system, with the instrumentation necessary to look at adsorption on a metal single crystal using LEED (Low Energy Electron Diffraction), Auger electron spectroscopy, mass-analyzed thermal desorption, and surface potential measurements. With these techniques the adsorption of CO, H2 (hydrogen) and other gases on various metal crystal faces are examined. Reflection-adsorption spectroscopy, along with mass-analyzed thermal desorption and Auger spectroscopy will be used also to study adsorption on evaporated metal films as well as metal-oxide catalyzed reactions of olefins. Finally, transmission spectroscopy will permit investigation of a small-particle effect on the spectra of molecules adsorbed on small metal particles supported on silica or alumina. The expected results may modify the interpretation of spectra obtained by other workers in a wide variety of infrared studies.

This is a continuation of research supported under DMR73-02346. First year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0039, SPECIAL FOREIGN CURRENCY AWARD FOR STUDY OF THE A-DEPENDENCE OF INCLUSIVE PROCESSES & ASSOCIATED MULTIPLICITY
P. Zielinski, Instytut Badan Jadrowych, *Swierk, Poland* (INT76-84354)

The award is for the support of a study of the A-dependence of inclusive processes using an M-6 focussing spectrometer facility and a neutral pi meson detector. For each inclusive event detected, the associated charge particles will also be detected and their angles measured. The purpose of the study is to explore general features of the space-time development of production processes over a wide kinematic region and also to answer specific questions raised by models to explain present data on multiparticle production in nuclei. Presently there is no single model which explains in a quantitative or qualitative manner all the features of hadron-nucleus collisions at high energies. These investigations, in addition to exposing new phenomena in the almost unexplored field of high energy interactions of elementary particles with nuclei, should significantly contribute to the understanding of the basic properties of nuclear matter.

The study will be conducted in collaboration with Professor Wit Busza of MIT and study groups at Brown University, Providence, RI, Fermi National Accelerator Laboratory, Batavia, IL, and the University of Bari, Italy.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Scientific Technological & Internat. Affairs, Div. of International Programs

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, SOLAR ATMOSPHERIC DYNAMICS
S.T. Wu, University of Alabama in Huntsville, School of Science & Engineering, Dept. of Mechanical Engineering, *Huntsville, Alabama* 35807 (ATM77-22484)

This grant will support the study of the following two problems: (1) Dynamics of the Solar Magnetic Field: Namely, what are the role and basic mechanisms of the change of magnetic field in the solar atmosphere and flares? and (2) Dynamics of Transients: Namely, what are the fundamental physical processes governing the observed transient phenomena in the solar atmosphere and wind?

In achieving these objectives, emphasis will be placed on the study of macroscopic dynamics so that the results will provide rational bases for the interpretation of observations. In addition, supplemental examinations will be considered on the physical processes affecting macroscopic dynamics, such as, the interaction between radiation and fluid motions (radiative hydrodynamics) and the interactions between particles and fields (plasma physics).

The specific objective of this work is to understand solar flares and the broader area is to further our understanding of magnetized plasma in the astrophysical context.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

10.0002, A HIGH RESOLUTION ECHELLE SPECTROGRAPH FOR ASTRONOMICAL SPECTROSCOPY
B.L. Lutz, Lowell Observatory, *P.O. Box 1269, Flagstaff, Arizona* 86001 (AST77-20606)

Funds will be provided for the construction of a high resolution Cassegrain Echelle Spectrograph for use with the 72 inch Perkins reflector at Lowell Observatory in Flagstaff, Arizona. The design of the instrument will be based on the Mark III version of the Smithsonian Institution's Mount Hopkins Cassegrain Echelle Spectrograph. This design has proven to be highly versatile and efficient for numerous observational projects and is ideally suited for moderate sized telescopes. The instrument will be designed to utilize modern detectors over the entire optical wavelength range and to take advantage of the broad wavelength coverage provided by the two-dimensional array of the Echelle format.

Observations to be made with this instrument include high resolution studies of planetary atmospheres, spectroscopy of interstellar clouds, and abundance studies of the atmospheres of late-type stars.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0003, INFRARED STUDIES OF STAR FORMATION
R.I. Thompson, University of Arizona, School of Liberal Arts, Dept. of Astronomy, *Tucson, Arizona* 85721 (AST78-20393)

This research will be devoted to a program of investigation of the protostellar and pre-main sequence states of star formation. Infrared spectroscopy will be used to obtain information on the properties of these objects. Such objects are often hidden at visible wavelengths by the surrounding dust. Because of this, often the only direct evidence on the properties of a protostellar object comes from infrared emission lines of hydrogen. It has been found that disks of material surround some newly forming stars. The properties of such disks will be studied. It has been suggested that these disks may be the site of planetary formation. The T Tauri stars are another type of pre-main sequence object. They have a variable light output. Many of these stars are surrounded by circumstellar dust shells. There are a number of problems associated with interpreting the phenomena observed from these stars. Information over as broad a wavelength band as possible is extremely useful in analyzing the physical properties of such systems. The facilities of the Steward Observatory will be used to carry out simultaneous optical and infrared monitoring of these stars.

Infrared emission lines due to molecular hydrogen have now been detected in the nucleus of a Seyfert galaxy. Since molecular hydrogen is observed in star formation regions of our own galaxy, it may be that star formation is taking place in external galaxies. Other galaxies will be observed in order to determine the extent of extragalactic molecular hydrogen emission. It may then be possible to determine star formation sites in external galaxies which are obscured from sight at visible wavelengths.

This is a continuation of research previously supported under NSF grant AST77 20369.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0004, A SENSITIVE NEAR-INFRARED PHOTOGRAPHIC SKY SURVEY
E.R. Craine, University of Arizona, Steward Observatory, *Tucson, Arizona* 85721 (AST76-19832 A01)

A wide-angle, high-resolution photographic survey of the entire northern sky will be carried out in near infrared wavelengths at high sensitivity (very deep limiting magnitudes). In the past, photography of this type was severely constrained by very slow photographic emulsions. A new and innovative approach will be used by applying the technology of high-gain, red-sensitive electronic image intensifiers to the problem of survey photography. The survey will be comparable in resolution to the widely used, shorter wavelength National Geographic Society-Palomar Observatory Sky Survey (NGS-PSS). The near infrared region of the spectrum will be used to avoid hydrogen emission features which 'black out' large regions of the sky on the NGS-PSS red plates. Huge new regions of the 'infrared' sky which have never been seen before will be investigated scientifically. In addition, the survey will 'look' through dust regions which obscure much of the galactic plane. The survey will provide an exciting new look at our galaxy and universe and will serve as a valuable complement for existing sky surveys undertaken at other wavelengths for problems of galactic and extragalactic astronomy.

This is a continuation of research done under grant AST 76-19832.

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Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0005, A SPECTROPOLARIMETER FOR THE LICK OBSERVATORY IMAGE TUBE SCANNER
J.P. Miller, University of California, Santa Cruz Campus, Graduate School, Dept. of Astronomy, *Santa Cruz, California* 95060 (AST78-19753)

The image tube scanner (ITS) of the Lick Observatory 120-inch Shane reflector is a highly productive instrument. It is used to obtain flux-calibrated spectra of astronomical objects. This grant will provide funds to support the addition of a polarimeter to the image tube scanner. The polarimeter will make it possible to simultaneously measure the polarization in both the sky and object at the full spectral resolution of the image tube scanner, making the device the only one of its kind on a large telescope. With this polarimeter it will be possible to make highly accurate polarization measurements with system noise reduced to an extremely low level. The instrument will be made available to all users of the 120-inch telescope. It will be used for research on quasi-stellar objects, Seyfert galaxies and related objects.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0006, STELLAR STRUCTURE AND EVOLUTION
J.P. Cox, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (AST77-23182 AO1)

Support is for continuation of studies in basic stellar structure and evolution. The second year of the grant will consider mainly the radial and nonradial stability of stars in various stages of evolution and other kinds of objects, including the sun. Associated investigations will include some effects of rotation.

Some areas of high energy astrophysics will be explored, such as the transport of X-rays in energy and space through circumstellar gas, and properties of X-ray sources in general.

Prior support was by NSF grant AST77-23182.

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Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0007, RADIO ASTRONOMICAL STUDIES OF THE SOLAR SYSTEM
J.W. Warwick, University of Colorado, Boulder Campus, School of Arts & Sciences, Dept. of Astro Geophysics, *1200 University Ave., Boulder, Colorado* 80302 (AST76-81577 A01)

The University of Colorado group will examine the radio emissions from the sun and planets in the meter and decameter wavelength range. Observations of Jupiter will be emphasized during the period when the two Voyager spacecraft are near that planet, to maximize the potential for a better description of the complex radio emissions and for an understanding of the underlying physical mechanism.

A compressive receiver designed and constructed under prior support will be used with antennas at the Colorado Radio Astronomy Observatory near Nederland, Colorado to: 1) Obtain high-speed radio spectral observations of the solar and Jupiter radio emissions (frequency range: 1 to 80 MHz; bandwidth: 50 KHz; minimum time per spectrum: 100 microsecs; mode: interferometer or polarimeter; poorest detectable flux density: the galactic flux density). 2) Analyze these data alongside in situ observations from the Voyager spacecraft encountering Jupiter in March and July, 1979.

Prior support was by NSF grant AST 76-81577.

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Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0008, MAPPING THE CHEMICAL PROPERTIES OF THE GALACTIC HALO BY PHOTOGRAPHIC AND PHOTOELECTRIC METHODS (ABBREV)
A. Sandage, Carnegie Institution of Washington, *1530 P St. N.W., Washington, District of Columbia* 20005 (AST78-00534)

A television guiding system will be installed on the 100 inch (2.5M) Mt. Wilson telescope of the Hale Observatories. The television system will store, integrate, and display the viewing field. The television system will allow remote operation of the telescope. The astronomer will not have to be located at the Newtonian or Cassegrain platform. The television guiding system will enable the astronomer to pick out the desired objects he wishes to observe and guide the telescope from a remote, convenient data room and thus the telescope will be used more efficiently.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0009, BINARY STAR SPECKLE INTERFEROMETRY
H.A. McAlister, Georgia State University, School of Arts & Sciences, Dept. of Physics, *33 Gilmer St. S.E., Atlanta, Georgia* 30303 (AST78-01743)

Support is for a program of binary star speckle interferometry with the 4-meter and 2.1-meter telescopes at Kitt Peak National Observatory to yield diffraction limited measures of the position angles and separations of close binary systems. The program includes spectroscopic, astrometric, spectrum, occultation and close visual binaries as well as stars suspected to be binary by indirect or incomplete evidence. The minimum resolvable separation of 0.03 arc-second with the 4-meter telescope offers a significant increase in sensitivity to new binaries. Observations of spectroscopic and astrometric binaries will permit the determination of new entries into the empirical mass-luminosity relation for stars, of fundamental importance to stellar astrophysics and evolution. Secondary goals include the improvement of existing binary star orbits, new orbits for systems that are difficult or impossible to observe by other techniques, and the search for planetary mass perturbations in the orbits of nearby visual binaries.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0010, ASTRONOMICAL DETECTOR DEVELOPMENT
T.B. McCord, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowala St., Honolulu, Hawaii* 96822 (AST76-81803 A01)

This grant will provide funds to enable silicon target (ST) vidicon and intensified silicon vidicon (SIT) image acquisition systems which have been developed at the Massachusetts Institute of Technology to be adapted to auxiliary instrumentation of the 2.24 meter telescope of the Mauna Kea Observatory of the University of Hawaii.

These systems will be used for a number of scientific programs at the Mauna Kea Observatory. These programs include observations of the ultraviolet emission features in T Tauri-type stars, the structure of the atmospheres of the major planets, line profiles in early type stars, and investigations of certain characteristics of galaxies and quasi-stellar objects.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0011, MORPHOLOGICAL INVESTIGATIONS OF STELLAR SPECTRA AND CLUSTERS OF GALAXIES
W.W. Morgan, University of Chicago, School of Physical Sciences, Dept. of Astronomy & Astrophysics, *5734 S. Ellis Ave., c/o Hinds Geophysics Lab., Chicago, Illinois* 60637 (AST76-21710 A01)

This project will provide funds for completion of the Revised MK Atlas for Stars Earlier than the Sun by Morgan, Abt

and Tapscott. This includes continued development of the spectral classification system. A few photographic sets of the new Atlas will be prepared; a printed edition will follow when the master negatives are completed.

A program aimed at classification of approximately 1000 stars on this revised system will be initiated. The Atlas consists almost exclusively of individual stars whose spectra define certain reference points in the two-dimensional spectral type luminosity-class diagram. Before effective use can be made of the Atlas, it will be necessary to produce a body of spectral types, determined by means of these standard stars, in such a manner that each frequently-used classification cell will contain at least ten stars.

Preparation of a General Catalog of cD Galaxies will begin. This will be a catalogue of clusters of galaxies containing supergiant cD galaxies, huge elliptically shaped galaxies frequently found in or near the centers of clusters of galaxies.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0012, NUCLEUS-NUCLEUS INTERACTIONS AT HIGH ENERGIES

W.V. Jones, Louisiana State University, Agricultural & Mechanical College, School of Chemistry & Physics, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (PHY77-01083)

A study of heavy nuclei interacting in nuclear emulsion is in progress. Data already exist in emulsions which were exposed to cosmic radiation in a balloon flight at a latitude corresponding to a geomagnetic cut-off of 1.5 GeV/nucleon. A second exposure to a beam of iron nuclei, 2.1 GeV/nucleon, is planned. The combination of the two exposures will enable measurements of nucleus-nucleus interaction events over a continuous range of energies up to 80 GeV/nucleon.

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Sciences, Div. of Physics

10.0013, INTERSTELLAR REDDENING IN THE SOLAR NEIGHBORHOOD

C.L. Perry, Louisiana State University, Agricultural & Mechanical College, School of Chemistry & Physics, Dept. of Physics & Astronomy, *University Station, Baton Rouge, Louisiana* 70803 (AST77-04056)

The mapping of the dust component of the interstellar medium using observations of stars in the solar neighborhood will be carried out. A network of approximately 3,600 stars has been established with the intent that the stars act as probes in space for the detection of individual dust clouds. The use of uvby beta photometry in conjunction with empirical calibrations will yield precise color excesses and absolute magnitudes.

The data collection process will be completed and the analysis will then be done. This study should then yield answers for such questions as: 1) The relative importance of reddening by discrete clouds versus a diffuse intercloud medium, 2) The space density of such clouds, 3) The linear sizes of the clouds, 4) The approximate distances of the clouds, and 5) Estimates of their masses.

Furthermore, it is anticipated that this investigation will be the basis of other programs such as a polarization of study of the galactic magnetic field in the solar vicinity.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0014, COMPOSITION AND CARBON-14 CONTENT OF GAS IN ICE AT THE ANTARCTIC METEORITE SITES

E.L. Fireman, Smithsonian Institution, Astrophysical Observatory, *60 Garden St., Cambridge, Massachusetts* 02138 (DPP78-05730)

Meteorites have been found in the ice at the edges of the antarctic ice sheet in recent years. These meteorites fell on the ice sheet tens of thousands of years ago and are now exposed in areas where the ice is being lost by melting and sublimation. The history of these meteorites may be deduced by their interrelationship with the ice. This proposed project will analyze gas in ice samples collected at the antarctic sites where the meteorites are found. The N2, O2, Ar, and CO2 contents, isotopic compositions, and the carbon-14 radioactivity will be measured. The combination of the age and composition of the gas in the ice with the fall times of the collected meteorites is a new source of information for glaciology, atmospherics, and meteoritics.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Polar Programs

10.0015, THE INTERACTIONS OF ENERGETIC PARTICLES WITH THE SOLAR WIND - A THEORETICAL STUDY

L.A. Fisk, University System of New Hampshire, University of New Hampshire, Graduate School, *Durham, New Hampshire* 03824 (ATM79-08353)

This grant funds a broad-based program of theoretical studies into energetic-particle interactions with the solar wind. The work to be undertaken includes: (1) the extension of current numerical models for the solar modulation of galactic cosmic rays to include the effects of curvature and gradient drifts, (2) the use of solar and cosmic-ray data, and the above numerical model, to develop a more realistic model for the causes of solar-cycle variations in the galactic cosmic ray flux, and (3) the development of a more reliable theory for the propagation of low-rigidity particles. The overall aim is to understand the interaction of the sun with energetic particles as a function of the solar cycle.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

10.0016, PREPARATION OF FINDING CHARTS FOR A CATALOG OF STARS WITH LARGE PROPER MOTIONS

H. Albers, Vassar College, Graduate School, Dept. of Astronomy, *Raymond Ave., Poughkeepsie, New York* 12601 (AST77-14166 A01)

Stars of large proper motion are almost always relatively close to the sun. A few stars at greater distances may show large proper motions due to their unusually rapid motion through space. Both kinds are of interest in determining the stellar population of the solar neighborhood. The fainter objects are stars of low luminosity, including red main sequence, subdwarf, and white dwarf stars. These furnish information about the faint end of the luminosity function near the sun.

A catalog of stars over the whole sky with proper motions greater than 0.5 seconds of arc per year has been compiled by Willem Luyten at the University of Minnesota from his extensive researches and all published sources. The catalog contains positions, magnitudes, colors, and motions for all the stars known at present to fall within this limit. Support by this award will permit finding charts to be made so that they can be published together with the statistical data. It is planned to provide finding charts for all stars except those already in standard catalogs so that the published catalog will be of maximum value to the observational astronomer. The charts will be done by the principal investigator, Dr. Henry Albers, at the University of Minnesota, working in collaboration with Dr. Luyten.

Prior support was by NSF grant AST 77-14166.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

10.0017, IMPROVEMENT IN THE QUALITY OF ASTRONOMY AND SCIENCE EDUCATION THROUGH THE USE OF AN OPTICAL OBSERVATORY

S.C. Dunford, University of North Carolina, East Carolina University, Graduate School, *Greenville, North Carolina* 27835 (SER77-05882)

The proposing organization, the Three College Observatory of Greensboro, North Carolina, which is a consortium consisting of The Univ. of North Carolina at Greensboro, North Carolina A & T State University, and Guilford College, presents a project with the purpose of improving education in astronomy.

The proposal is based on the belief that a significant improvement in science education in general and instruction in astronomy in particular will be accomplished by the use of modern observational equipment.

An optical observatory containing a 24-inch telescope and a television camera system will be employed to provide astronomy students with day-to-day class contact with the telescope. A video tape library of common astronomical objects as seen through the telescope will be used to supplement class lectures in introductory astronomy courses. Equipping the telescope with a 4 x 5 astronomical camera will provide opportunity for numerous student research projects at an advanced undergraduate level. When not engaged in project activities, the proposed telescope may be used as a community resource. Viewing nights for local residents could be scheduled on a regular basis and the television system used to provide video tapes of astronomical objects to local TV stations.

Project evaluation will be conducted with the assistance of an outside evaluator working with the project staff during the first and third summers of the project.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Science Education, Div. of Science Education Resources Improvement

10.0018, ANALYSIS OF DATA FROM THE MAGNETOSPHERE AND SOLAR WIND

A.J. Dessler, Rice University, Graduate School, Dept. of Space Physics & Astronomy, *6100 Main St., Houston, Texas* 77001 (ATM77-12619 A01)

This grant will support an investigation of a limited number of specific, well-defined questions relating to the physics of the earth's magnetosphere, through an extensive and coordinated program of theoretical development and analysis of data from a variety of past and present satellite and ground-based experiments. This program will involve a large measure of cooperation among several American and European scientific institutions and will contribute in a significant way towards the overall objectives of the International Magnetospheric Study (IMS).

The research is directed towards answering the following three fundamental questions: (1) How does the solar wind control the electric potential drop across the polar cap that drives magnetospheric convection; (2) What mechanisms are responsible for the injection and acceleration of solar-wind plasma at the magnetopause; and (3) What are the relationships among magnetospheric convection patterns, auroral morphology, particle precipitation patterns, and field-aligned currents.

Theoretical research on the above topics has advanced to a stage where several significant observational tests are necessary and feasible. Several other crucial tests will become feasible during the period of the IMS, given a modest level of effort in refining and applying existing theory. The intent is to provide a balanced program of coordinated data analysis and theoretical development that will complement and enhance the data-acquisition programs of the IMS.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N80-28295* National Aeronautics and Space Administration, Washington, D. C.
AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES
Jun. 1980 152 p
(NASA-SP-7037(123)) Avail: NTIS HC $5.00 CSCL 01A

This bibliography lists 529 reports, articles, and other documents introduced into the NASA Scientific and Technical Information System in May 1980. Author

N80-28296*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPREHENSIVE ANALYTICAL MODEL OF ROTORCRAFT AERODYNAMICS AND DYNAMICS. PART 1: ANALYSIS DEVELOPMENT
Wayne Johnson Jun. 1980 442 p refs Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif. 2 Vol.
(NASA-TM-81182; AVRADCOM-TR-80-A-5-Pt-1; A-8100) Avail: NTIS HC A19/MF A01 CSCL 01B

Structural, inertia, and aerodynamic models were combined to form a comprehensive model of rotor aerodynamics and dynamics that is applicable to a wide range of problems and a wide class of vehicles. A digital computer program is used to calculate rotor performance, loads, and noise; helicopter vibration and gust response; flight dynamics and handling qualities; and system aeroelastic stability. The analysis is intended for use in the design, testing, and evaluation of rotors and rotorcraft, and to be a basis for further development of rotary wing theories. A.R.H.

N80-28297*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPREHENSIVE ANALYTICAL MODEL OF ROTORCRAFT AERODYNAMICS AND DYNAMICS. PART 2: USER'S MANUAL
Wayne Johnson Jul. 1980 97 p Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif. 2 Vol.
(NASA-TM-81183; AVRADCOM-TR-80-A-6-Pt-2; A-8101) Avail: NTIS HC A05/MF A01 CSCL 01B

The use of a computer program for a comprehensive analytical model of rotorcraft aerodynamics and dynamics is described. The program calculates the loads and motion of helicopter rotors and airframe. First the trim solution is obtained, then the flutter, flight dynamics, and/or transient behavior can be calculated. Either a new job can be initiated or further calculations can be performed for an old job. E.D.K.

N80-28298*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPREHENSIVE ANALYTICAL MODEL OF ROTORCRAFT AERODYNAMICS AND DYNAMICS. PART 3: PROGRAM MANUAL
Wayne Johnson Jun. 1980 155 p Prepared in cooperation with Army Aviation Research and Development Command, St. Louis, Mo.
(NASA-TM-81184; AVRADCOM-TR-80-A-7; A-8102) Avail: NTIS HC A08/MF A01 CSCL 01B

The computer program for a comprehensive analytical model of rotorcraft aerodynamics and dynamics is described. This analysis is designed to calculate rotor performance, loads, and noise; the helicopter vibration and gust response; the flight dynamics and handling qualities; and the system aeroelastic stability. The analysis is a combination of structural, inertial, and aerodynamic models that is applicable to a wide range of problems and a wide class of vehicles. The analysis is intended for use in the design, testing, and evaluation of rotors and rotorcraft and to be a basis for further development of rotary wing theories. Author

N80-28299# Battelle Columbus Labs., Ohio.
THE GENERAL AVIATION DYNAMICS MODEL. VOLUME 3: SYSTEMS MANUAL Final Report, 2 Sep. 1977 - 30 May 1979
M. A. Duffy and J. H. McCreery Jul. 1979 313 p
(AD-A085007; FAA-AVP-79-8-Vol-3) Avail: NTIS HC A14/MF A01 CSCL 01/3

Under this contract, the model was updated based on data through 1976 and the results were presented in a two volume technical document covering the current model development efforts and all prior work done by Battelle. Volume 3, Systems Manual, provides a thorough description of the computer software aspects of the model. This includes a complete listing of the program, an example of a batch run of the model, a user handbook for the NUCLEUS programming language, and a user's guide for running the model interactively. GRA

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-28300* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
SYSTEM FOR USE IN CONDUCTING WAKE INVESTIGATION FOR A WING IN FLIGHT Patent
Paul F. Bikle, inventors (to NASA) and Lawrence C. Montoya Issued 15 Jul. 1980 9 p Filed 28 Feb. 1979 Supersedes N79-17797 (17 - 09, p 1069)
(NASA-Case-FRC-11024-1; US-Patent-4,212,199; US-Patent-Appl-SN-015983; US-Patent-Class-73-861.66; US-Patent-Class-73-180; US-Patent-Class-73-182; US-Patent-Class-73-861.65) Avail: US Patent and Trademark Office CSCL 01A

A system supported by a wing in flight is described which

has a reference total pressure port in spaced relation with a wake as the wake is generated by the wing, a reference static pressure port supported in spaced relation with the wake, and a probe adapted to be displaced along an accurate path through the wake including a total pressure port and static pressure ports. A differential pressure transducer and a pressure switching device are interposed between the ports and the transducer is provided for selectively connecting pairs of the ports to the transducer in opposed relation, whereby a single transducer is utilized to obtain differential pressure measurement for the wake with enhanced accuracy.

Official Gazette of the U.S. Patent and Trademark Office

N80-28301# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.

TURBULENT FLOWS IN AN IDEALIZED WING-BODY JUNCTION Ph.D. Thesis - London Univ.

Ibrahim Mohamed Mohamed Aly Shabaka and P. Bradshaw Apr. 1979 421 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Dec. 1980 or Jan. 1981

Avail: NTIS HC A18/MF A01

The interaction between the two boundary layers in the corner of an idealized wing body junction was investigated using an uncambered wing of constant thickness downstream of a half elliptic nose fixed to the tunnel floor to simulate the body surface. The lateral skewing of streamlines in the tunnel floor boundary layer, caused by the wing leading edge, induces streamwise vorticity in the corner region. The results show that this induced vortex overwhelms the stress-induced secondary flow over the entire region of measurement (about 25 wing thicknesses downstream of the leading edge). Regions where the body-oriented and wing-oriented shear stresses attain negative values were detected. Eddy-viscosity or mixing-length models are unsuitable for treating the present type of flow. The two dimensionality and local equilibrium of the inner layers of the body and wing boundary layers are not affected by the presence of the streamwise vortex except very near to the wing leading edge and in the vicinity of the corner. The ratio between the shear stress and the turbulent kinetic energy is constant over the flow except close to the corner. A.R.H.

N80-28302*# Atmospheric Science Associates, Bedford, Mass.

CALCULATION OF WATER DROP TRAJECTORIES TO AND ABOUT ARBITRARY THREE-DIMENSIONAL BODIES IN POTENTIAL AIRFLOW Final Report

Hillyer G. Norment Washington NASA Aug. 1980 83 p refs

(Contract NAS3-22199)

(NASA-CR-3291) Avail: NTIS HC A05/MF A01 CSCL 20D

Calculations can be performed for any atmospheric conditions and for all water drop sizes, from the smallest cloud droplet to large raindrops. Any subsonic, external, non-lifting flow can be accommodated; flow into, but not through, inlets also can be simulated. Experimental water drop drag relations are used in the water drop equations of motion and effects of gravity settling are included. Seven codes are described: (1) a code used to debug and plot body surface description data; (2) a code that processes the body surface data to yield the potential flow field; (3) a code that computes flow velocities at arrays of points in space; (4) a code that computes water drop trajectories from an array of points in space; (5) a code that computes water drop trajectories and fluxes to arbitrary target points; (6) a code that computes water drop trajectories tangent to the body; and (7) a code that produces stereo pair plots which include both the body and trajectories. Code descriptions include operating instructions, card inputs and printouts for example problems, and listing of the FORTRAN codes. Accuracy of the calculations is discussed, and trajectory calculation results are compared with prior calculations and with experimental data. Author

N80-28303*# De Havilland Aircraft Co. Ltd., Downsview (Ontario).

PHASE 1 WIND TUNNEL TESTS OF THE J-97 POWERED, EXTERNAL AUGMENTOR V/STOL MODEL

D. B. Garland Jul. 1980 101 p refs

(Contract NASw-2797)

(NASA-CR-152255; DHC-DND-79-4) Avail: NTIS HC A06/MF A01 CSCL 01A

Test results are presented for a large scale, external augmentor V/STOL model in a 40 ft by 80 ft wind tunnel. The model was powered by a GE J97 engine and featured longitudinal ejectors alongside and external to the fuselage together with an augmentor flap on the low aspect ratio, double-delta wing. A static thrust augmentation ratio of 1.60 was measured for the fuselage augmentor at a nozzle pressure ratio of 3.0 and a nozzle exhaust gas temperature of 700 C. At forward speed the model showed a strong positive lift interference due to the augmentor flap, and a marked absence of negative lift interference due to the fuselage augmentor jet system. The nose-up moment of the fuselage augmentor inlet flow was approximately cancelled by a 60 deg deflection of the augmentor flap. An assessment of the thrust and drag components to allow the prediction of transition performance of aircraft designs based on the present conceptual model was made. Lateral tests showed strong but well ordered effects of power. L.F.M.

N80-28304*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

WATER-TUNNEL AND ANALYTICAL INVESTIGATION OF THE EFFECT OF STRAKE DESIGN VARIABLES ON STRAKE VORTEX BREAKDOWN CHARACTERISTICS

Neal T. Frink and John E. Lamar Aug. 1980 92 p refs

(NASA-TP-1676; L-13254) Avail: NTIS HC A05/MF A01 CSCL 01A

A systematic water-tunnel study was made to determine the vortex breakdown characteristics of 43 strakes. The strakes were mounted on a 1/2-scale model of a Langley Research Center general research fighter fuselage model with a 44deg leading-edge-sweep trapezoidal wing. The analytically designed strake shapes provided examples of the effects of the primary design parameters (size, span, and slenderness) on vortex breakdown characteristics. These effects were analyzed in relation to the respective strake leading-edge suction distributions. Included were examples of the effects of detailed strake planform shaping. It was concluded that, consistent with the design criterion, those strakes with leading-edge suction distributions which increase more rapidly near, and have a higher value at, the spanwise tip of the strake produce a more stable vortex. Author

N80-28305*# Oklahoma State Univ., Stillwater. School of Mechanical and Aerospace Engineering.

STUDY OF BOUNDARY-LAYER TRANSITION USING TRANSONIC-CONE PRESTON TUBE DATA Semiannual Progress Report, Jan. - Jun. 1980

T. D. Reed and P. M. Moretti Jun. 1980 99 p refs

(Contract NsG-2396)

(NASA-TM-81103) Avail: NTIS HC A05/MF A01 CSCL 01A

The laminar boundary layer on a 10 degree cone in a transonic wind tunnel was studied. The inviscid flow and boundary layer development were simulated by computer programs. The effects of pitch and yaw angles on the boundary layer were examined. Preston-tube data, taken on the boundary-layer-transition cone in the NASA Ames 11 ft transonic wind tunnel, were used to develope a correlation which relates the measurements to theoretical values of laminar skin friction. The recommended correlation is based on a compressible form of the classical law-of-the-wall. The computer codes successfully simulates the laminar boundary layer for near-zero pitch and yaw angles. However, in cases of significant pitch and/or yaw angles, the flow is three dimensional and the boundary layer computer code used here cannot provide a satisfactory model. The skin-friction correlation is thought to be valid for body geometries other than cones. A.R.H.

N80-28306*# Pratt and Whitney Aircraft Group, East Hartford, Conn.

ANALYTICAL MODELS FOR USE IN FAN INFLOW CONTROL STRUCTURE DESIGN. INFLOW DISTORTION AND ACOUSTIC TRANSMISSION MODELS Interim Report

M. R. Gedge Dec. 1979 160 p refs

(Contract NAS1-15085)

(NASA-CR-159189; PWA-5580-32) Avail: NTIS HC A08/MF A01 CSCL 01A

Analytical models were developed to study the effect of flow contraction and screening on inflow distortions to identify

qualitative design criteria. Results of the study are that: (1) static testing distortions are due to atmospheric turbulence, nacelle boundary layer, exhaust flow reingestion, flow over stand, ground plane, and engine casing; (2) flow contraction suppresses, initially, turbulent axial velocity distortions and magnifies turbulent transverse velocity distortions; (3) perforated plate and gauze screens suppress axial components of velocity distortions to a degree determined by the screen pressure loss coefficient; (4) honeycomb screen suppress transverse components of velocity distortions to a degree detetmined by the length to diameter ratio of the honeycomb; (5) acoustic transmission loss of perforated plate is controlled by the reactance of its acoustic impedance; (6) acoustic transmission loss of honeycomb screens is negligible; and (7) a model for the direction change due to a corner between honeycomb panels compares favorably with measured data.
L.F.M.

N80-28307*# Mississippi State Univ., Mississippi State.
AN APPROXIMATE FACTORIZATION SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR TRANSONIC FLOW USING BODY-FITTED COORDINATES WITH APPLICATION TO NACA 64A010 AIRFOILS
G. Kyle Copper Aug. 1980 120 p refs
(Grant NGR-25-001-055)
(NASA-CR-163376) Avail: NTIS HC A06/MF A01 CSCL 01A

The implementation of the approximate factorization algorithm and its ability to efficiently and accurately describe transonic flow about an NACA 64A010 airfoil section is examined. The approximate factorization algorithm is developed from the nondimensional, conservative, vectorized Navier-Stokes equations expressed in curvilinear coordinates. Equations of state and transport coefficient relations appropriate to atmospheric air are appended to close the system of partial differential equations. An algebraic turbulence model is also incorporated into the equation set. This algorithm was verified by investigating the flow about an NACA 64A010 airfoil at 0, 2, and 3.5 deg angle of attack for free-stream conditions of 2,000,000 Reynolds number and 0.8 Mach number. Overall results were in good qualitative agreement with wind tunnel data sets. However, while nondimensional times of six were attained, numerical difficulties prevented any case from reaching a true steady state.
M.G.

N80-28308*# Analytical Methods, Inc., Bellevue, Wash.
AN ANALYSIS METHOD FOR MULTI-COMPONENT AIRFOILS IN SEPARATED FLOW
B. M. Rao, F. A. Duorak, and B. Maskew Aug. 1980 43 p refs
(Contract NAS1-25729)
(NASA-CR-159300) Avail: NTIS HC A03/MF A01 CSCL 01A

The multi-component airfoil program (Langley-MCARF) for attached flow is modified to accept the free vortex sheet separation-flow model program (Analytical Methods, Inc.-CLMAX). The viscous effects are incorporated into the calculation by representing the boundary layer displacement thickness with an appropriate source distribution. The separation flow model incorporated into MCARF was applied to single component airfoils. Calculated pressure distributions for angles of attack up to the stall are in close agreement with experimental measurements. Even at higher angles of attack beyond the stall, correct trends of separation, decrease in lift coefficients, and increase in pitching moment coefficients are predicted.
Author

N80-28309*# Cambridge Hydrodynamics, Inc., Mass.
DRAG REDUCTION EFFECTS IN TURBULENT BOUNDARY LAYERS OVER WAVY WALLS Final Report
R. Balasubramanian and Steven A. Orszag Aug. 1980 42 p refs
(Contract NAS1-15754)
(NASA-CR-159305; CHI-41) Avail: NTIS HC A03/MF A01 CSCL 01A

Two dimensional incompressible flow over wavy surfaces are analyzed numerically by spectral methods. Algorithms for periodic flows (Fourier modes in the periodic flow direction and Chebycheff modes in the normal direction), and inflow-outflow boundary conditions (Chebycheff modes used in both directions) are described. Results obtained using both codes are reported for laminar flows. Comparisons with known theoretical and experimental results are made.
Author

N80-28310# Flow Research, Inc., Kent, Wash.
THREE-DIMENSIONAL FLOW CALCULATION BASED ON EQUIVALENCE RULE Final Report
Mohamed Hafez Nov. 1979 6 p
(Contract N00014-76-C-0880)
(AD-A085245) Avail: NTIS HC A02/MF A01 CSCL 20/4

Transonic flows around three dimensional configurations are calculated based on the artificial compressibility method. The transonic nonlinear mixed-type equation is treated as if it were elliptic, and the artificial viscosity is added implicitly through modifying the density. Thus, standard discretization techniques and standard iterative procedures are applicable. The output of the full three dimensional code are compared to the results of numerical implementation of two asymptotic theories; transonic equivalence rule and transonic lifting line. While the analytical asymptotic theories are limited to low or high aspect ratio configurations, it is found that the numerical algorithms based on these concepts can be employed efficiently in a wider range than the range where the asymptotic theories are strictly valid.
GRA

N80-28311# Douglas Aircraft Co., Inc., Long Beach, Calif.
STUDIES ON THREE-DIMENSIONAL BOUNDARY LAYERS ON BODIES OF REVOLUTION. PART 2: THREE-DIMENSIONAL LAMINAR BOUNDARY LAYERS AND THE OK OF ACCESSIBILITY Final Report, 15 Sep. 1978 - 15 Dec. 1979
Tuncer Cebeci, A. A. Khattab, and Keith Stewartson Apr. 1980 66 p refs
(Contract N60921-78-C-0158; WR02302003)
(AD-A085159; MDC-J8716) Avail: NTIS HC A04/MF A01 CSCL 20/4

An investigation is carried out into the structure of the laminar boundary layer originating from the forward stagnation point of a prolate spheroid at incidence in a uniform stream, assuming that the external velocity distribution is given by attached potential theory. The principal new results of the study are: (1) a new transformation of the body coordinates is devised which facilitates the computation of the solution near the nose; (2) two variations of the standard box method of solving the equations are devised to enable solutions to be computed in regions of cross-flow reversal; (3) whereas in two dimensional flows the effect of the boundary layer approaching separation on the external flow may be represented by a blowing velocity, in the present study we find that this is only true near the windward line of symmetry; (4) the boundary layer over the whole of the spheroid cannot be computed on an integration from the forward stagnation point; and (5) For alpha = or > 15 deg the accessible region on the leeward side of the OK is largely determined by the external streamline through the OK.
GRA

N80-28312# Naval Ship Research and Development Center, Bethesda, Md.
AERODYNAMIC CHARACTERISTICS OF THE CLOSE-COUPLED CANARD AS APPLIED TO LOW-TO-MODERATE SWEPT WINGS. VOLUME 3: TRANSONIC-SUPERSONIC SPEED REGIME Final Report, 1970 - 1974
David W. Lacey Dec. 1979 184 p refs
(WF14142109)
(AD-A085065; DTNSRDC-79/003) Avail: NTIS HC A09/MF A01 CSCL 20/4

An analysis of the effects of canard shape, position, and deflection on the aerodynamic characteristics of two general research models having leading edge sweep angles of 25 and 50 degrees is presented. The analysis summarizes findings of three experimental transonic wind-tunnel programs and one supersonic wind-tunnel program conducted at this Center between 1970 and 1974. The analysis is based on four canard geometries varying in planform from a 60 degree delta to a 25 degree swept wing, high aspect ratio canard. The canards were tested at several positions and deflected from -10 to +10 degrees. In addition, configurations consisting of a horizontal tail and a canard with horizontal tails are analyzed. Results of the analysis indicate that the canard is effective in increasing lift and decreasing drag at Mach numbers from subsonic to high transonic speeds by

delaying wing separation. The effectiveness of the canard is, however, decreased with increasing Mach number. At supersonic speeds the canard has little or no favorable effects on lift or drag. It is further shown that the horizontal tail is a superior trimming device than the close-coupled canard at low-to-moderate angles of attack and that a configuration consisting of canard, wing, and horizontal tail is superior in performance, to either canard or horizontal tail at high angles of attack. GRA

N80-28313# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
SUPPRESSION OF AERODYNAMICALLY INDUCED CAVITY PRESSURE OSCILLATIONS Final Technical Report, Feb. 1975 - May 1979
Leonard L. Shaw Nov. 1979 62 p refs
(AF Proj. 2401)
(AD-A084837; AFFDL-TR-79-3119) Avail: NTIS HC A04/MF A01 CSCL 20/4

A flight test program was performed to gain further insight into the phenomenon of flow-induced cavity pressure oscillations and to evaluate the effectiveness of suppression concepts in eliminating or reducing the pressure oscillations. The cavities tested were rectangular with approximate dimensions of 17 inches long, 8.5 inches deep, and 8.75 inches wide and were instrumented with microphones, static pressure ports, and a thermocouple. The flight speeds ranged from Mach number 0.6 to 1.3 at pressure altitudes of 3,000, 20,000, and 30,000 feet. The suppression devices included leading edge spoilers and deflectors and trailing edge ramps and deflectors. Several combinations of these were tested. The results indicate that the flow induced pressure oscillations in a cavity of the dimensions tested and for the speed range tested can be significantly reduced with leading edge spoilers in conjunction with a trailing edge ramp. Reductions as large as 30 dB were achieved for the predominant model frequency for a one-third octave band. Other combinations of the suppression devices afforded some reduction, but the spoiler ramp combination proved most effective. GRA

N80-28314# Illinois Univ. at Urbana-Champaign. Mechanical Engineering Lab.
AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF MULTIPLE DUCTED STREAMS WITH A PERIODIC OR A STEADY SUPERSONIC DRIVER FLOW M.S. Thesis. Final Report, 1976-1980
H. L. Petrie and A. L. Addy Jan. 1980 170 p refs
(Grant DAAG29-76-G-0200)
(AD-A084786; UILU-ENG-80-4002; ARO-13737.2-EX) Avail: NTIS HC A08/MF A01 CSCL 20/4

An experimental and theoretical investigation of a supersonic-subsonic, two dimensional planar, constant area ejector with a periodically pulsed or a steady driver flow is discussed. A large scale fluidic oscillator was developed to partially pulse the driver flow at frequencies up to 250 Hz. A wide range of ejector flow conditions were experimentally investigated with three values of ejector mixing duct length-to-width ratios. Driver flow frequencies of 142 Hz and 250 Hz were used in the ejector experiments and a complete set of steady driver flow experiments was conducted. A one dimensional, quasi-steady control volume analysis was successfully employed to model these ejector flows. Unsteady ejector flows were found to be modeled well by the quasi-steady analysis. Both steady and unsteady ejector flow performance parameters were accurately predicted by the one dimensional analysis with the exception of the pressure recovery characteristics observed. Experimentally determined compression ratios were about 25% lower than predicted by the analysis. The pulsation of the driver flow was found to have little effect on ejector operation. GRA

N80-28315# Illinois Univ. at Urbana-Champaign. Mechanical Engineering Lab.
A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF TRANSONIC FLOW IN THE THROAT REGION OF ANNULAR AXISYMMETRIC, SUPERSONIC NOZZLES Ph.D. Thesis
J. C. Dutton and A. L. Addy Jan. 1980 188 p refs
(Contract DAAG29-79-C-0184; Grant DAAG29-76-G-0200)
(AD-A084787; UILU-ENG-80-4001; ARO-13737.1-EX; ARO-16719.1-E) Avail: NTIS HC A09/MF A01 CSCL 20/4

An integrated theoretical and experimental investigation of flow in the throat region of unconventional, annular, supersonic nozzles was conducted. The theoretical analysis consists of the formulation and development of an approximate series expansion solution to the inviscid, irrotational governing equations. The resulting solution provides a direct means of analyzing the throat flowfields in a variety of two dimensional nozzle configurations including axisymmetric, annular, and planar nozzles. A major advantage of the solution is the speed and reliability of its numerical implementation, making feasible parametric studies and iterative calculations. GRA

N80-28316# Lockheed-Georgia Co., Marietta.
ACQUISITION AND APPLICATION OF TRANSONIC WING AND FAR-FIELD TEST DATA FOR THREE-DIMENSIONAL COMPUTATIONAL METHOD EVALUATION, VOLUME 1 Final Report, May 1978 - Aug. 1979
B. L. Hinson and K. P. Burdges Mar. 1980 217 p refs
(Contract F49620-78-C-0068; AF Proj. 2307)
(AD-A085258; LG80ER0012-Vol-1; AFOSR-80-0421TR) Avail: NTIS HC A10/MF A01 CSCL 20/4

A comprehensive program to acquire high Reynolds number transonic experimental data on three advanced technology wings of aspect ratio from 2.8 to 8.0, specifically for evaluation of three dimensional computational methods, was accomplished. The wings were tested over a wide range of conditions isolated wings and in the presence of a simple fuselage in high, mid, and low wing configurations on a unique test apparatus in the Lockheed-Georgia compressible flow wind tunnel. The unique test apparatus included provisions for removal of the wind tunnel boundary layer and measurements of far-field pressures for evaluation of wind tunnel wall interference. A unique technique for evaluation of wind tunnel wall interference was developed and applied to the data. Selected three dimensional transonic computational methods were compared with the test data. A Full potential code, FLO-22, was found to give excellent agreement with experiment for all three wings, while a small disturbance solution provided acceptable agreement only for the high aspect ratio wing. GRA

N80-28317# Lockheed-Georgia Co., Marietta.
ACQUISITION AND APPLICATION OF TRANSONIC WING AND FAR-FIELD TEST DATA FOR THREE-DIMENSIONAL COMPUTATIONAL METHOD EVALUATION. VOLUME 2, APPENDIX B: EXPERIMENTAL DATA Final Report, May 1978 - Aug. 1979
B. L. Hinson and K. P. Burdges Mar. 1980 750 p
(Contract F29620-78-C-0068; AF Proj. 2307)
(AD-A085259; LG80ER0012-Vol-2; AFOSR-80-0422TR) Avail: NTIS HC A99/MF A01 CSCL 20/4

This volume contains an extensive set of experimental pressure data for wings A, B, and C. This includes data for all isolated wing and wing/fuselage configurations. No far-field pressure data, however, are included. GRA

N80-28318# Rutgers - The State Univ., New Brunswick, N. J. Dept. of Mechanical, Industrial and Aerospace Engineering.
CALCULATION OF HIGH SPEED INLET FLOWS USING THE NAVIER-STOKES EQUATIONS. VOLUME 1: DESCRIPTION OF RESULTS Final Report, Apr. 1978 - Sep. 1979
Doyle D. Knight Wright-Patterson AFB, Ohio AFFDL Feb. 1980 121 p refs Presented at 18th AIAA Aerospace Sci. Meeting, Pasadena, Calif., Jan. 1980
(Contract F33615-78-C-3008; AF Proj. 2307)
(AD-A084789; AFFDL-TR-79-3138-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 21/5

A set of computer programs has been developed to calculate the flowfield in two dimensional mixed-compression high speed inlets. The full mean compressible Navier-Stokes equations are utilized, with turbulence represented by an algebraic eddy viscosity model which incorporates a relaxation correction. A curvilinear body-oriented coordinate system is employed to allow handling of arbitrary inlet contours. Boundary layer bleed is incorporated. The numerical algorithm of MacCormack is employed to solve the Navier-Stokes equations. A variety of techniques are incorporated to improve code efficiency, including time-splitting of the finite-difference operators, automatic mesh-splitting, and

a separate algorithm for the treatment of the viscous sublayer portion of the turbulent boundary layers. The numerical codes have been successfully applied to the calculation of a variety of flows including shock-boundary layer interaction on a flat plate (including both unseparated and separated cases), and three different simulated high speed inlet configurations. In all cases, good agreement was obtained with the experimental data. GRA

N80-28319# Rutgers - The State Univ., New Brunswick, N. J. Dept. of Mechanical, Industrial and Aerospace Engineering.
CALCULATION OF HIGH SPEED INLET FLOWS USING THE NAVIER-STOKES EQUATIONS. VOLUME 2: USER'S AND PROGRAMMER'S GUIDE Final Report, Apr. 1978 - Sep. 1979
Doyle D. Knight Wright-Patterson AFB, Ohio AFFDL Feb. 1980 138 p refs
(Contract F33615-78-C-3008; AF Proj. 2307)
(AD-A084790; AFFDL-TR-79-3138-Vol-2) Avail: NTIS HC A07/MF A01 CSCL 21/5

A series of four computer programs used to compute the flowfield within a two dimensional, mixed compression, high speed, aircraft inlet are documented. a brief description is presented of the physical problem and the mathematical model. The numerical methods are discussed and the limitations of the approach are indicated. A brief summary of the four programs is presented together with the general sequence of application. The coordinate system programs are discussed in detail with emphasis on the pertinent criteria for successful implementation. The details of the Navier-Stokes code employed for solution of the inlet flowfield are presented. In addition, the details of a simple utility program used to interpolate flow filed data are discussed. E.D.K.

N80-28320# Aeronautical Research Inst. of Sweden, Stockholm. Dept. of Aerodynamics.
A PRELIMINARY WIND TUNNEL STUDY OF WINDMILL WAKE DISPERSION IN VARIOUS FLOW CONDITIONS, PART 7
Per-Henrik Alfredsson and Jan-Ake Dahlberg 12 Oct. 1979 74 p refs 6 Vol.
(Contract SWEDBESD-5061-012)
(FFA-AU-1499-Pt-7) Avail: NTIS HC A04/MF A01

Measurements of the wake development behind a small rotating model of a wind turbine unit were carried out. The ambient flow conditions were varied by using turbulence grids, a simulated atmospheric boundary layer, and by placing the model near a smooth wall. Mean velocity and turbulence profiles for the different flow conditions were also calculated. The measurements were also analyzed with respect to the decay of the center line velocity defect and the inflow of mass into the wake. Photographs of the vortex structure behind the wind turbine model are presented. Author (ESA)

N80-28321# Aeronautical Research Inst. of Sweden, Stockholm. Dept. of Aerodynamics.
A PRELIMINARY EVALUATION OF A MODEL PROPOSED BY P. LISSAMANN FOR THE WAKE BEHIND A ROTOR IN A TURBULENT FLOW, PART 11
Fritz H. Bark 12 Oct. 1979 37 p refs 6 Vol.
(Contract SWEDBESD-5061-012)
(FFA-AU-1499-Pt-11) Avail: NTIS HC A03/MF A01

Results from a slightly modified version of a theoretical model for the wake behind a rotor in a turbulent flow are compared with experimental results obtained in a wind tunnel. It is shown that the model gives results in excellent agreement with the experiments in the far wake if the upstream flow contains grid generated turbulence. For the case without any grid generated turbulence, the agreement is not satisfactory. This discrepancy may partly be caused by difficulties in estimating the momentum loss accurately enough from the experiments. The momentum loss enters the model as a parameter. In the near wake, the model gives even less satisfactory results, independent of the turbulence level in the upstream flow. Author (ESA)

N80-28322# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
A CORRELATION OF MACH 7 BOUNDARY LAYER TRANSITION DATA FROM THE LOUGHBOROUGH GUN TUNNEL
E. R. Bergstrom Oct. 1979 37 p refs
(Grant SRC-B/RG/3323.2)
(TT-7904) Avail: NTIS HC A03/MF A01

A direct correlation of boundary layer transition Reynolds number with freestream aerodynamic noise for all Mach 7 flat plate and cylinder gun tunnel data is presented. An original speculative correlation in which the tunnel noise levels were estimated by a semi-empirical method is compared with a few fully measured data. Both data groups are shown to align to within the limitations imposed by the noise estimation method thereby suggesting some validity in the correlation form. In restating the transition correlations, corrections and additions to earlier gun tunnel noise measurements and the semi-empirical method are presented. Author (ESA)

N80-28323# Royal Aircraft Establishment, Farnborough (England). Structures Dept.
EXPANSIONS IN SERIES OF CHEBYSHEV POLYNOMIALS OF A FUNCTION OCCURRING IN LINEAR UNSTEADY AERODYNAMIC THEORY
D. E. Davies London Aeron. Res. Council Jul. 1979 70 p refs Supersedes RAE-TR-77110; ARC-37998
(ARC-R/M-3840; BR73032; RAE-TR-77110; ARC-37998) Avail: NTIS HC A04/MF A01; HMSO £12 PHI

In linearized unsteady aerodynamics the function s sub n (alpha), defined as the integral from zero to infinity of (le sup - i alpha u) / (u squared + 1) sup n + 1/2) du for n > or = 1, has to be evaluated for many values of alpha. Expansions of functions in terms of series of Chebyshev polynomials can be used for rapid evaluation of the functions. A procedure to obtain such expansions of s sub n (alpha) is considered for all real alpha and all integer n > or = zero. Numerical values of the coefficients of the series of Chebyshev polynomials obtained with a FORTRAN program are given. The leading coefficients are shown to twelve significant decimal digits. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-28324# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
MICROPHYSICAL PROPERTIES OF ARTIFICIAL AND NATURAL CLOUDS AND THEIR EFFECTS ON UH-1H HELICOPTER ICING Final Report, Jan. - Mar. 1979
Grady W. Wilson and Ralph Woratschek Aug. 1979 102 p refs
(AD-A084633; USAAEFA-78-21-2) Avail: NTIS HC A06/MF A01 CSCL 01/3

Natural and artificial icing tests were conducted from 22 January to 22 February 1979 in the vicinity of St. Paul, MN with follow-on natural tests conducted from 26 February to 21 March 1979 in the vicinity of Syracuse, NY. A total of 6.7 hours were flown in the artificial environment and 7.8 hours in the natural environment. Artificial conditions were tested at liquid water content (LWC) range of 0.25 to 0.90 gm/m to the 3rd power with a temperature range of -10 to -20 C. Natural conditions were encountered at LWC range of 0.06 to 0.23 gm/m to the 3rd power and a temperature range of -2.5 to -22 C. Tests were conducted to determine the feasibility of operational deployment of a partial ice protection system consisting of electrothermally heated windshields, a sensitive outside air temperature (OAT) system, a LWC indicator and associated electrical changes. The test aircraft was a JUH-1H helicopter equipped with electrothermally decided blades as a safety device and laser nephelometers which were used to quantify the microphysical properties of the test environment. It was determined that the artificial environment (Helicopter Icing Spray System (HISS)) was not an adequate simulation in its present configuration. This was due in part to the large droplet size, heterogeneous characteristic of the plume and concentration of

large droplets in the lower portion of the plume. It was also determined that the partial ice protection system did not increase the operational capability of the UH-1H helicopter and that LWC is not an adequate indication of icing severity. GRA

N80-28325# Technology, Inc., San Antonio, Tex. Life Sciences Div.
PROCEDURAL TESTS OF ANTI-G PROTECTIVE DEVICES. VOLUME 1: PROCEDURAL TESTS FOR ANTI-G VALVES Final Report, 1 Oct. 1976 - 30 Jun. 1978
Roy W. Thompson, Carmen E. Galvan, Paul E. Love, and Arnold G. Krueger Dec. 1979 169 p 2 Vol.
(Contract F33615-77-C-0610; AF Proj. 7930)
(AD-A084792; SAM-TR-79-30-Vol-1) Avail: NTIS HC A19/MF A01 CSCL 06/17

In the first volume of the two in this study report, the instrumentation, data recording, and computerized data analysis techniques for acceleration response and performance studies are described in detail. The results of performance testing of 5 anti-G valves are reported. GRA

N80-28328# Office of Technology Assessment, Washington, D. C.
IMPACT OF ADVANCED AIR TRANSPORT TECHNOLOGY. PART 1: ADVANCED HIGH-SPEED AIRCRAFT
William E. Howard Apr. 1980 115 p refs
(OTA-T-112-Pt-1) Avail: NTIS HC A06/MF A01

The economic, environmental, energy, societal and safety impacts of advances in high-speed aircraft technology were examined to determine the potential benefits of advanced supersonic transport aircraft and the justification for Federal funding to support development of this technology. Results indicate that: the long term prospects for advanced supersonic transports are significant and real; the uncertainties, specifically, fuel price and availability, noise, and market size, are also significant and real, and the potential threat from foreign competitors appears tempered by the same research uncertainties. Other significant results are reported. DOE

N80-28327# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Direction Etudes.
AIRCRAFT SAFETY [SECURITE DU VEHICLE AERIEN]
P. Toulouse Paris 13 Apr. 1979 21 p ref In FRENCH; ENGLISH summary
(SNIAS-792-111-105) Avail: NTIS HC A02/MF A01

The way in which air transportation risks are identified from both experience and analysis is described. The probabilistic approach used to decrease the likelihood of occurrence of accidents and to minimize their consequences is also described. Author (ESA)

N80-28329# Societe Nationale Industrielle Aerospatiale, Paris (France).
SUPERSONIC TRANSPORT: THE PAST, PRESENT AND THE FUTURE [LE TRANSPORT SUPERSONIQUE: LE PASSE, LE PRESENT ET L'AVENIR]
22 Apr. 1979 18 p In FRENCH
(SNIAS-792-111-107) Avail: NTIS HC A02/MF A01

The history of the Concorde project is presented. Attention is drawn to certain miscalculations in estimating the time necessary for its development and realization. Attention is also drawn to differences between financial, economic and social conditions prevailing at the time when it was conceived and today, notably concerning the potential market (initially the sale of several hundred models was envisaged) and environmental and ecological pressures. Author (ESA)

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-28329*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ALGORITHM FOR FIXED-RANGE OPTIMAL TRAJECTORIES
Homer Q. Lee and Heinz Erzberger Jul. 1980 86 p refs
(NASA-TP-1565; A-8003) Avail: NTIS HC A05/MF A01 CSCL 17G

An algorithm for synthesizing optimal aircraft trajectories for specified range was developed and implemented in a computer program written in FORTRAN IV. The algorithm, its computer implementation, and a set of example optimum trajectories for the Boeing 727-100 aircraft are described. The algorithm optimizes trajectories with respect to a cost function that is the weighted sum of fuel cost and time cost. The optimum trajectory consists at most of a three segments: climb, cruise, and descent. The climb and descent profiles are generated by integrating a simplified set of kinematic and dynamic equations wherein the total energy of the aircraft is the independent or time like variable. At each energy level the optimum airspeeds and thrust settings are obtained as the values that minimize the variational Hamiltonian. Although the emphasis is on an off-line, open-loop computation, eventually the most important application will be in an on-board flight management system. E.D.K.

N80-28330*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
ANALYTICAL METHODOLOGY FOR DETERMINATION OF HELICOPTER IFR PRECISION APPROACH REQUIREMENTS
Anil V. Phatak Jul. 1980 124 p refs
(Contract NAS2-10291)
(NASA-CR-152367) Avail: NTIS HC A06/MF A01 CSCL 17G

A systematic analytical approach to the determination of helicopter IFR precision approach requirements is formulated. The approach is based upon the hypothesis that pilot acceptance level or opinion rating of a given system is inversely related to the degree of pilot involvement in the control task. A nonlinear simulation of the helicopter approach to landing task incorporating appropriate models for UH-1H aircraft, the environmental disturbances and the human pilot was developed as a tool for evaluating the pilot acceptance hypothesis. The simulated pilot model is generic in nature and includes analytical representation of the human information acquisition, processing, and control strategies. Simulation analyses in the flight director mode indicate that the pilot model used is reasonable. Results of the simulation are used to identify candidate pilot workload metrics and to test the well known performance-work-load relationship. A pilot acceptance analytical methodology is formulated as a basis for further investigation, development and validation. Author

N80-28331# National Aviation Facilities Experimental Center, Atlantic City, N. J.
FLIGHT EVALUATION OF A RADAR CURSOR TECHNIQUE AS AN AID TO AIRBORNE RADAR APPROACHES Interim Report, Jul. - Aug. 1979
J. Perez Mar. 1980 38 p
(AD-A084015; FAA-NA-80-8; FAA-RD-80-18) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report presents preliminary results of a flight test evaluation of a radar cursor technique to be used as an aid in acquiring and tracking the desired ground track during airborne radar approaches. The test was performed using a Sikorsky CH-53A helicopter on loan from NASA and based at NAFEC. The airborne radar system used was a BENDIX RDR-1400A modified to electronically produce a radar cursor display of course error. Airborne radar approaches were made to an offshore

and an airport test environment located within a 60 nautical mile radius of NAFEC. Systems Control, Inc. (SCI), provided contractor services in the areas of test planning, data reduction, and final report preparation. The specific purpose of the test was to evaluate the practical utility of the radar cursor as an aid to performing airborne radar approaches. The preliminary conclusion of this test was that the use of the radar cursor improved course acquisition and ground tracking significantly with pilotage errors and total system cross-track errors reduced by one-half or better. The radar cursor technique showed potential in reducing airspace requirements for airborne radar approaches. SCI is presently completing data reduction and analysis and will publish a final report in the near future. GRA

N80-28332# Naval Electronic Systems Engineering Activity, St. Inigoes, Md.
CERTIFICATION TEST PROCEDURES FOR AIRCRAFT APPROACH CONTROL, AN/SPN-41, REVISION
1 May 1979 66 p
(AD-A084385; NESEA-79-30-22-Rev.; NESEA-022-106A-Rev) Avail: NTIS HC A04/MF A01 CSCL 17/9

Aircraft Approach Control AN/SPN-41, composed of shipboard and airborne equipments, can be used as an independent landing aid or as a Mode 1 monitor on AN/SPN-42A equipped carriers. In order to satisfactorily accomplish this monitoring, each piece of equipment must operate within allowable tolerances. These tests are designed to provide the criteria for initial and periodic checks of the system to ensure operation within acceptable limits. There are three categories of certification tests. Category 1 tests are the basic equipment tests. Category 2 tests are pierside flights to check the system alignment and correlation of the AN/SPN-41 with the AN/SPN-42A and the Fresnel Lens Optical Landing System (FLOLS). Category 3 tests are the at-sea flight tests using aircraft equipped to record data. GRA

N80-28333# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
SAZEL: A COMPUTER PROGRAM TO FIND SUN AZIMUTH AND ELEVATION
Edward F. Brown Apr. 1980 46 p refs
(AD-A085020; AD-E400414; ARLCD-TR-79010) Avail: NTIS HC A03/MF A01 CSCL 09/2

A computer program, SAZEL, is presented which computes the Sun azimuth and elevation angle from an observer's geographic location, local mean time, and calendar date. The method of computing the Sun azimuth and elevation angle is discussed in detail and in application. GRA

N80-28334# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GENERATION OF THE DISCRETE ADDRESS BEACON SYSTEM (DABS) NETWORK COVERAGE MAP Final Report
David Reiner 20 Mar. 1980 61 p refs
(Contracts F19628-78-C-0002; DOT-FA72WAI-261)
(AD-A085129; FAA-RD-80-39) Avail: NTIS HC A04/MF A01 CSCL 17/7

This paper describes the technique of designing the network management coverage map files necessary to coordinate a network of DABS sensors. First, the concept of the DABS network is defined, and the functions of Network Management are briefly described, as they relate to the coverage map. Then, the rationale for the coverage map is given together with definitions of the map structure and the information required in the file. Implementation of these definitions is illustrated in terms of a specific example: a network of four DABS sensors in the Washington, D.C. area. As configured, each of the sensors provides service to only one of four ATC facilities (three TRACONs and one ARTCC). The resulting map generation process illustrates not only the general principles but also the significant effects of ATC control area geometry and ATARS requirements. Finally, the procedure required for automated map generation is defined. This procedure assumes the use of an interactive computer display terminal and is applicable to any sensor network and ATC facility configuration. GRA

N80-28335# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DISCRETE ADDRESS BEACON SYSTEM (DABS) INSTALLATION AND SITING CRITERIA Final Report
R. G. Sandholm 29 Jan. 1980 36 p refs
(Contract DOT-FA72WAI-261; FAA Proj. 052-241-04)
(AD-A085178; FAA-RD-80-40) Avail: NTIS HC A03/MF A01 CSCL 17/7

This paper provides information on site-associated phenomena that affect the proper operation of a DABS sensor and therefore warrant serious consideration when siting a sensor. The DABS-related discussion is intended to be a supplement to the ATCRBS siting criteria presented in the FAA Primary/Secondary Terminal Radar Siting Handbook. The paper discusses siting criteria as they relate to the DABS sensor antenna system, as opposed to the ATCRBS hogtrough antenna, and importantly, addresses those characteristics of the surrounding environment that are crucial to proper DABS/ATARS surveillance. GRA

N80-28336# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DISCRETE ADDRESS BEACON SYSTEM (DABS) FUNCTIONAL DESCRIPTION Final Report
V. A. Orlando and P. R. Drouilhet Apr. 1980 105 p refs
(Contract DOT-FA72WAI-261; FAA Proj. 052-241-04)
(AD-A085169; ATC-42A) Avail: NTIS HC A06/MF A01 CSCL 17/7

This document provides a functional description of the Discrete Address Beacon System (DABS), a combined secondary surveillance radar (beacon) and ground-air-ground data link system capable of providing the aircraft surveillance and communications necessary to support ATC automation in future traffic environments. DABS is capable of common-channel interoperation with the current ATC beacon system, and may be implemented at low user cost over an extended ATCRBS-to-DABS transition period. In supporting ATC automation, DABS will provide the surveillance and communication performance required by the Automatic Traffic Advisory and Resolution Service (ATARS), the reliable communications needed to support data link services, and the capability of operating with a terminal or enroute, radar digitizer-equipped, ATC surveillance radar. GRA

N80-28337# Mitre Corp., McLean, Va. Metrek Div.
DISCRETE ADDRESS BEACON SYSTEM/AUTOMATED TRAFFIC ADVISORY AND RESOLUTION SERVICE/AIR TRAFFIC CONTROL OPERATIONAL SYSTEM DESCRIPTION Final Report
J. E. Dieudonne and R. W. Lautenschlager Apr. 1980 121 p refs
(Contract DOT-FA80WA-4370)
(AD-A085180; MTR-79W00436; FAA-RD-80-42) Avail: NTIS HC A06/MF A01 CSCL 17/7

This document describes the Discrete Address Beacon System (DABS) sensor and the collocated Automatic Traffic Advisory and Resolution Service (ATARS) function relative to their interactions with the Air Traffic Control (ATC) facilities. A general description of the Terminal and En Route ATC facility modifications for integration with the initial deployment of DABS sensors is provided. The document discusses: the characteristics and use of the surveillance data, the exchange of messages between the ATC facility by means of the DABS air-ground data link and some potential applications, the interaction between ATARS and the ATC facility, and the exchange of information between DABS and the ATC facility relative to status and control information. The actions performed by the DABS sensor are summarized, the messages involved in the transactions between DABS and the ATC facility are described and the actions by the ATC facility are discussed. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-28338* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A PILOTED SIMULATOR ANALYSIS OF THE CARRIER LANDING CAPABILITY OF THE QUIET SHORT-HAUL

RESEARCH AIRCRAFT
Dennis W. Riddle Jul. 1980 41 p refs
(NASA-TM-78508; A-7528) Avail: NASA, Ames Res. Center, Moffett Field, Calif. 94035 CSCL 01C

A moving-base carrier landing simulation was conducted to evaluate the carrier landing capability of the Quiet Short-Haul Research Aircraft. Statistical results show that for an optimized approach configuration utilizing direct lift control, landings to a full stop can be safely executed (without use of arresting gear) with 40% of the landing deck remaining and without exceeding 50% of the design touchdown sink rate. Even under adverse sea state and wind conditions, the maximum allowable touchdown sink rate and minimum touchdown pitch attitude limits were never exceeded. Using the optimized approach configuration, successful go-arounds can be executed at any time during the approach, even when into the landing flare maneuver. L.F.M.

N80-28339*# Rensselaer Polytechnic Inst., Troy, N. Y. Composite Structural Program.
COMPOSITE STRUCTURAL MATERIALS Semiannual Report, Sep. 1979 - Apr. 1980
George S. Ansell, Robert G. Loewy, and Stephen E. Wiberley Jun. 1980 152 p refs Sponsored in part by AFOSR
(Grant NGL-33-018-003)
(NASA-CR-163377; SAR-38) Avail: NTIS HC A08/MF A01 CSCL 01C

The use of filamentary composite materials in the design and construction of primary aircraft structures is considered with emphasis on efforts to develop advanced technology in the areas of physical properties, structural concepts and analysis, manufacturing, and reliability and life prediction. The redesign of a main spar/rib region on the Boeing 727 elevator near its actuator attachment point is discussed. A composite fabrication and test facility is described as well as the use of minicomputers for computer aided design. Other topics covered include (1) advanced structural analysis methods for composites; (2) ultrasonic nondestructive testing of composite structures; (3) optimum combination of hardeners in the cure of epoxy; (4) fatigue in composite materials; (5) resin matrix characterization and properties; (6) postbuckling analysis of curved laminate composite panels; and (7) acoustic emission testing of composite tensile specimens. A.R.H.

N80-28340*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PARAMETRIC STUDY OF MODERN AIRSHIP PRODUCTIVITY
Mark D. Ardema and Kenneth Flaig Jul. 1980 52 p refs
(NASA-TM-81151; A-7993) Avail: NTIS HC A04/MF A01 CSCL 01C

A method for estimating the specific productivity of both hybrid and fully buoyant airships is developed. Various methods of estimating structural weight of deltoid hybrids are discussed and a derived weight estimating relationship is presented. Specific productivity is used as a figure of merit in a parametric study of fully buoyant ellipsoidal and deltoid hybrid semi-buoyant vehicles. The sensitivity of results as a function of assumptions is also determined. No airship configurations were found to have superior specific productivity to transport airplanes. L.F.M.

N80-28341*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A PILOT'S ASSESSMENT OF HELICOPTER HANDLING-QUALITY FACTORS COMMON TO BOTH AGILITY AND INSTRUMENT FLYING TASKS
Ronald M. Gerdes Jul. 1980 20 p refs
(NASA-TM-81217; A-8263) Avail: NTIS HC A02/MF A01 CSCL 01C

A series of simulation and flight investigations were undertaken to evaluate helicopter flying qualities and the effects of control system augmentation for nap-of-the-Earth (NOE) agility and instrument flying tasks. Handling quality factors common to both tasks were identified. Precise attitude control was determined to be a key requirement for successful accomplishment of both tasks. Factors that degraded attitude controllability were improper levels of control sensitivity and damping, and rotor system cross coupling due to helicopter angular rate and collective pitch input. Application of rate command, attitude command, and control input decouple augmentation schemes enhanced attitude control and significantly improved handling qualities for both tasks. The NOE agility and instrument flying handling quality considerations, pilot rating philosophy, and supplemental flight evaluations are also discussed. L.F.M.

N80-28342# Textron Bell Helicopter, Fort Worth, Tex.
CONCEPTUAL DESIGN OF A HELICOPTER COMPOSITE TRUSS TAIL BOOM Final Report
David A. Gallian Apr. 1980 118 p
(Contract DAAK51-78-C-0016; DA Proj. 1L1-62209-AH-76)
(AD-A085132; USAAVRADCOM-TR-80-D-8) Avail: NTIS HC A06/MF A01 CSCL 01/3

This report presents the results of a conceptual study of a helicopter composite truss tail boom. The study included the following tasks: design criteria, material properties, truss design and analysis, manufacturing techniques, and fabrication and ballistic testing. The results of the study indicate that a composite truss is a viable concept for a ballistically tolerant tail boom. GRA

N80-28343# Boeing Vertol Co., Philadelphia, Pa.
HEAVY LIFT HELICOPTER: PROTOTYPE TECHNICAL SUMMARY Final Report, Jan. 1973 - Aug. 1975
Apr. 1980 356 p refs
(Contract DAAJ01-71-C-0840)
(AD-A085290; D301-10323-1; USAAVRADCOM-TR-80-D-11)
Avail: NTIS HC A16/MF A01 CSCL 01/3

This report summarizes the Heavy Lift Helicopter (HLH) Prototype program. The program was designed to demonstrate, in the actual flight environment, the capabilities of HLH components previously developed by Boeing Vertol under the Advanced Technology Components (ATC) effort. Design, fabrication, and assembly of one prototype HLH was 90 percent completed. An advanced aluminum honeycomb airframe, landing gear, and subsystems not included in the ATC effort were designed and fabricated. Limited laboratory tests were conducted to assure airworthiness of the prototype aircraft. Mockups were constructed of the crew compartment and aft area. A description of the aircraft, discussion of the tests conducted, and weight and performance data are presented. A list of references containing detailed documentation of the program is appended. GRA

N80-28344# Lockheed-Georgia Co., Marietta.
PERIPHERAL JET AIR CUSHION LANDING SYSTEM SPANLOADER AIRCRAFT, VOLUME 1 Final Report, Jul. - Dec. 1979
J. W. Moore, L. Barnett, B. T. Farmer, E. E. McBride, B. I. Reynolds, and R. E. Stephens Wright-Patterson AFB, Ohio AFFDL Dec. 1979 154 p refs
(Contract F33615-79-C-3029; AF Proj. 2404)
(AD-A085203; LG79ER0177-Vol-1; AFFDL-TR-79-3152-Vol-1)
Avail: NTIS HC A08/MF A01 CSCL 01/2

Inherent in the design optimization of wing span-distributed load (spanloader) aircraft is the lack of ground operational down bending load reaction capability of the wing structure. It is necessary to provide a means to react these down bending loads if the wing structural weight is minimized. Recent studies have provided wide tread landing gears as a means to react these down bending loads, limiting the operational capability of the aircraft where the tread width exceeds most existing airport taxiway or runway widths. This study examines the feasibility of replacing the wide tread gear with a peripheral jet air cushion landing system (PJ-ACLS) in combination with a minimum tread (75 feet) width gear. The PJ-ACLS is located adjacent to the wing tip and is used primarily as wing down bending load reaction device. The minimum tread width gear is retained to simplify takeoff and landing procedures and to reduce the magnitude of the lift required from the PJ-ACLS. GRA

N80-28345# Lockheed-Georgia Co., Marietta.
PERIPHERAL JET AIR CUSHION LANDING SYSTEM SPANLOADER AIRCRAFT, VOLUME 2 Final Report, Jul. - Dec. 1979
J. W. Moore, L. Barnett, B. T. Farmer, E. E. McBride, B. I. Reynolds, and R. E. Stephens Wright-Patterson AFB, Ohio AFFDL Dec. 1979 298 p refs

(Contract F33615-79-C-3029; AF Proj. 2404)
(AD-A085117; LG79ER0177-Vol-2; AFFDL-TR-79-3152-Vol-2)
Avail: NTIS HC A13/MF A01 CSCL 01/2

The output of a computerized peripheral jet cushion landing system performance program is presented. The input matrix evaluated is as follows: cushion length (%b/2); cushion load or lift (%GW); jet toe-in angle (theta) degrees; and jet thickness (t) inches. These input data are evaluated for the baseline Sparlloader configuration where cushion and landing gear are reduced by 40 inches to represent a configuration which incorporates a flat bottom airfoil shape. R.C.T.

N80-28346# Societe Nationale Industrielle Aerospatiale, Toulouse (France). Directions Etudes.

TRANSPARENT MATERIALS FOR CIVIL AIRCRAFT [OBJET: TRANSPARENTS POUR AVIONS CIVILS]

Frustie Paris 26 Mar. 1979 33 p In FRENCH Presented at Assoc. Aeron. et Astronautique de France/ONERA Conf., 29 Mar. 1979
(SNIAS-792-111-108) Avail: NTIS HC A03/MF A01

The characteristics required for both windshields and port windows subsonic and supersonic aircraft are described. The following subjects are treated: nature of materials and systems used, quality requirements (pressure and impact resistance, optical properties, endurance, defrosting possibilities, weight, resistance to abrasion manufacturing techniques and heat treatments. The evolution that has taken place over recent years in the design of such systems and in the materials used is discussed together with experience with A 300 B material and future developments expected in this field. Author (ESA)

N80-28347# Societe Nationale Industrielle Aerospatiale, Marignane (France.) Div. Helicopteres.

IMPACT OF MODERN MATERIALS ON THE DEVELOPMENT OF HELICOPTERS [IMPACTS DES MATERIAUX MODERNES SUR LE DEVELOPPEMENT DES APPAREILS A VOILURES TOURNANTES]

G. Petit and F. dAmbra Paris 1979 35 p In FRENCH
(SNIAS-792-210-123) Avail: NTIS HC A03/MF A01

The modern materials (plastics, composite materials, etc.) currently used in the construction of helicopters are presented. A review is given of the main objectives sought by the contractor: reduction of mass and costs, and improving performance and operational characteristics. Emphasis is given to the special techniques and procedures (both design and industrial manufacturing phases) employed together with the quality control and operational behavior studies performed. Author (ESA)

N80-28348# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

TECHNICAL EVALUATION REPORT ON THE FLIGHT MECHANICS PANEL SYMPOSIUM ON THE USE OF COMPUTERS AS A DESIGN TOOL

Siegfried N. Wagner (Hochschule der Bundeswehr, Munich) Mar. 1980 21 p refs Symp. presented at Munich, 3-6 Sep. 1979
(AGARD-AR-158; ISBN-92-835-1353-3) Avail: NTIS HC A02/MF A01

The application of computer technology to aircraft design is considered. Specific topics covered include: specifications and assessment of requirements; computer aided design and computer graphics; computational aerodynamics and design; structural analysis and design; and propulsion and systems design. The primary conclusions are that the human being still plays a critical role during all steps of computerized aircraft design and that remarkable progress has been made in many areas related to aircraft design because of recent developments in computer hardware and software. However, there are still areas where the designer has to relay rely on wind tunnel and structural testing. The computer has reduced the routine workload of the engineer to save time for creative work, but there is still a need for faster and larger computers that will probably incorporate new architectures. J.M.S.

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-28349*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AN EXPERIMENTAL EVALUATION OF HEAD-UP DISPLAY FORMATS

J. M. Naish and Donna L. Miller (Informatics, Inc., Palo Alto, Calif.) Jul. 1980 78 p refs
(NASA-TP-1550; A-7970) Avail: NTIS HC A05/MF A01 CSCL 01D

Three types of head-up display format are investigated. Type 1 is an unreferenced (conventional) flight director, type 2 is a ground referenced flight path display, and type 3 is a ground referenced director. Formats are generated by computer and presented by reflecting collimation against a simulated forward view in flight. Pilots, holding commercial licenses, fly approaches in the instrument flight mode and in a combined instrument and visual flight mode. The approaches are in wind shear with varied conditions of visibility, offset, and turbulence. The displays are equivalent in pure tracking but there is a slight advantage for the unreferenced director in poor conditions. Flight path displays are better for tracking in the combined flight mode, possibly because of poor director control laws and the division of attention between superimposed fields. Workloads is better for the type 2 displays. The flight path and referenced director displays are criticized for effects of symbol motion and field limiting. In the subjective judgment of pilots familiar with the director displays, they are rated clearly better than path displays, with a preference for the unreferenced director. There is a fair division of attention between superimposed fields. Author

N80-28350# Intermetrics, Inc., Dayton, Ohio.

DIGITAL AVIONICS INFORMATION SYSTEM (DAIS): MISSION SOFTWARE Final Report, 23 Jun. 1975 - 28 Feb. 1979

W. H. Vandever, Jr., S. F. Stanten, P. Y. Williams, D. A. Flanders, S. Z. Stein, S. E. Adams, and N. Eastridge Wright-Patterson AFB, Ohio AFWAL Feb. 1980 153 p refs
(Contract F33615-75-C-1181; AF Proj. 2092)
(AD-A085136; AFWAL-TR-80-1003) Avail: NTIS HC A08/MF A01 CSCL 09/3

The significance of this research and development to the Air Force is the demonstration of the applicability of modern software techniques and methodology to the generation of sophisticated, flexible avionics software with excellent life cycle costs and easy maintainability. The DAIS Mission Software was coded in J73/1 and based its structure upon the relocatability concepts known as Higher Order Software (HOS). GRA

N80-28351# Sikorsky Aircraft, Stratford, Conn.

ADVANCED SUBSYSTEM STATUS MONITOR Final Report, Oct. 1978 - Oct. 1979

J. McGee and H. Harper Apr. 1980 262 p
(Contract DAAK51-78-C-0023; DA Proj. 1L1-62209-AH-76)
(AD-A085135; SER-510025; USAAVRADCOM-TR-80-D-5)
Avail: NTIS HC A12/MF A01 CSCL 01/3

Five tasks were completed toward the design of an advanced Subsystem Status Monitor that will reduce crew workload during the monitoring of helicopter subsystems: (1) analysis of parameters currently monitored in the UH-60A, CH-47C, OH-58C, and AH-1G Army helicopters, and recommendation of information requirements for these helicopters; (2) development of prioritization, logic, and display formats for the presentation of subsystem information on multi-function electronic displays for the above-mentioned helicopters; (3) preliminary design of system architectures incorporating state-of-the-art, near-term and long-term technologies into an advanced Subsystem Status Monitor; (4) evaluation of preliminary designs to determine predicted impacts on flight safety, workload, reliability and maintainability, survivability and vulnerability, aircraft space and volume, aircraft weight, and life cycle costs; (5) design of keyboard and associated

display formats for the following peripheral functions: checklist presentation, performance calculation, and load monitoring. GRA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.

N80-28352*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OFF-DESIGN CORRELATION FOR LOSSES DUE TO PART-SPAN DAMPERS ON TRANSONIC ROTORS

William B. Roberts, James E. Crouse, and Donald M. Sandercock Jul. 1980 24 p refs

(NASA-TP-1693; E-309) Avail: NTIS HC A02/MF A01 CSCL 21E

Experimental data from 10 transonic fan rotors were used to correlate losses created by part-span dampers located near the midchord position on the rotor blades. The design tip speed of these rotors varied from 419 to 425 m/sec, and the design pressure ratio varied from 1.6 to 2.0. Additional loss caused by the dampers for operating conditions between 50 and 100 percent of design speed were correlated with relevant aerodynamic and geometric parameters. The resulting correlation predicts the variation of total-pressure-loss coefficient in the damper region to a good approximation. Author

N80-28353*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PERFORMANCE ESTIMATION FOR HIGHLY LOADED SIX AND TEN BLADE PROPELLERS COMBINED WITH AN ADVANCED TECHNOLOGY TURBOSHAFT ENGINE

Shelby J. Morris, Jr. Jun. 1980 22 p refs

(NASA-TM-81840) Avail: NTIS HC A02/MF A01 CSCL 21E

Performance estimations, weights, and scaling laws for the six blade and ten blade highly loaded propellers combined with an advanced turboshaft engine are presented. These data are useful for aircraft mission studies using the turboprop system. Comparisons are made between the performance of post 1980 technology turboprop propulsion systems and the performance of both a current technology turbofan and a post 1990 technology turbofan. Author

N80-28354# General Accounting Office, Washington, D. C. Procurement and Systems Acquisition Div.

IS THE JOINT AIR FORCE/NAVY ALTERNATE ENGINE PROGRAM WORKABLE? GAO THINKS NOT, AS PRESENTLY STRUCTURED

9 May 1980 34 p

(AD-A084709; GAO/PSAD-80-40) Avail: NTIS HC A03/MF A01 CSCL 21/5

This report describes the joint Air Force/Navy alternate engine program and discusses the need to (1) identify program objectives and (2) structure the program on a realistic basis that avoids taking overly ambitious steps under the guise of a modification program. The report also suggests that the program as presently conceived may not satisfy the directive of the Defense Appropriations Conference Committee and perhaps should be terminated. Our review of the joint services' alternate engine program is part of an overall review of the Department of Defense's acquisition process for aircraft gas turbine engines. The alternate engine program is one of the first derivative fighter engine programs initiated under the Air Force's new concept for engine development. GRA

N80-28355# Lincoln Lab., Mass. Inst. of Tech., Lexington.

REMOTE SENSING OF TURBINE ENGINE GASES Final Report, 15 Jul. 1978 - 30 Sep. 1979

Aram Morradian, Dennis K. Killinger, and Norman Menyuk 30 Sep. 1979 84 p refs

(Contract F19628-78-C-0002)

(AD-A084544; ESD-TR-79-319; AFESC/ESL-TR-80-09) Avail: NTIS HC A05/MF A01 CSCL 20/5

This document is the final report for a laser remote sensing research program. The research conducted was designed to develop and demonstrate laser remote sensing techniques for monitoring jet aircraft exhaust gases. This effort was part of a larger program to develop remote sensing techniques for environmental monitoring and tactical detection and discrimination. The specific tasks which were performed consisted of the following: (1) development of an improved repetition rate miniature CO2 TEA laser and incorporation into a differential-absorption LIDAR(DIAL) system, (2) laboratory demonstration of the frequency-doubled CO2 TEA laser system by differential-absorption measurements of known gas samples (CO and NO), and (3) initial field feasibility demonstration of laser remote detection of CO in vehicular exhaust (automobile, tractor mower and Skycrane helicopter) at ranges up to 2.5 km. Each of these tasks is described in detail in the following sections of this report. In addition, supportive documentation is included in the accompanying appendices. GRA

N80-28356# Naval Postgraduate School, Monterey, Calif.

EFFECTS OF FUEL ADDITIVES ON PLUME OPACITY OF A SUBSCALE TURBOJET TEST CELL WITH A RAMJET TYPE DUMP COMBUSTOR M.S. Thesis

Thomas Richard Darnell Dec. 1979 77 p refs

(AD-A084516) Avail: NTIS HC A05/MF A01 CSCL 21/5

An initial investigation was conducted into the effects of metallic based fuel additives on smoke reduction in turbojet test cells. Experiments were conducted on a one-eighth scale turbojet test cell with a ramjet type pump-combustor. Measurements of particle sizes and concentrations were made using light transmittance at two wavelengths. Particulate samples were collected and examined with a scanning electron microscope. Increased combustor temperatures and fuel additives appeared to affect particle size and concentration primarily downstream of the engine exhaust. Recommendations are made for experimental technique improvements which are required to improve the quality of data. GRA

N80-28357# ARO, Inc., Arnold Air Force Station, Tenn.

DEVELOPMENT AND TESTING OF A RESONANCE SOURCE GAS FILTER CORRELATION SPECTROMETER Final Report, Aug. - Sep. 1979

C. J. Fisher and R. J. Bryson AEDC May 1980 26 p refs

(AD-A084396; AEDC-TR-79-98) Avail: NTIS HC A03/MF A01 CSCL 14/2

The development and testing of a resonance source gas filter correlation spectrometer for carbon monoxide concentration measurement in high temperature, possibly acoustically and optically noisy combustion systems are described. The instrument incorporates a microwave-excited, low-pressure carbon monoxide plasma radiation source. The operation, calibration, and modeling of the instrument response as well as application to the measurement of CO concentration in the exhaust of a jet engine combustor are described. The report concludes with suggestions for the further use and development of the instrument. GRA

N80-28358# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Aerospace Power Div.

COMPUTER SIMULATION OF AUXILIARY POWER SYSTEMS Final Technical Report, 1 Jul. 1974 - 30 Nov. 1979

Daniel J. Gurecki Mar. 1980 66 p refs

(AF Proj. 3145)

(AD-A084858; AFAPL-TR-79-2118) Avail: NTIS HC A04/MF A01 CSCL 10/2

A digital computer program for the analysis of Auxiliary Power Units (APUs) has been developed. It analyzes the thermodynamics of each component, compressor, combustor, and turbine with regards to basic performance parameters and bleed leakage flows. On the first pass, the code solves the available horsepower from the APU on the basis of input component pressure ratio and efficiencies. On the second pass, the component performance is solved to satisfy the desired design shaft horsepower of the APU. This code is called APU code. GRA

N80-28359# Naval Postgraduate School, Monterey, Calif.
A COMPARISON OF SOLID FUEL RAMJET FLOW CHARACTERISTICS AND COMBUSTION BEHAVIOR M.S. Thesis
Brian Andrew Binn Dec. 1979 83 p refs Sponsored by Naval Weapons Center
(AD-A085064) Avail: NTIS HC A05/MF A01 CSCL 21/5

An experimental investigation was conducted to determine if there is a relationship between the cold flow characteristics of velocity, pressure distribution, and turbulence intensity and the reacting flow performance and combustion characteristics of a solid fuel ramjet. The effects of configuration and air flow changes on the above characteristics were examined. Average regression rates and combustion efficiencies were not significantly affected by changes in configuration. These variations in test conditions significantly affected the center-line turbulence intensity but not the near-wall turbulence intensity in cold flow. The use of bypass resulted in decreases in regression rate and efficiencies for all cases. Attainable performance appears to be most strongly related to near-wall turbulence intensity/mixing and to the amount of fuel reaching the aft mixing chamber. GRA

N80-28360# Brandeis Univ., Waltham, Mass. Dept. of Physics.
CRUISE MISSILE ENGINE PROGRAM. CONTRACT DATA REQUIREMENTS LIST SEQUENCE NUMBER 90. QUALIFICATION TEST REPORT. VOLUME 25: COMPONENT OIL RESERVOIR F-1-7-WR-102 AND F107-WR-400 CRUISE MISSILE ENGINES Final Report, 15 Aug. 1976 - 31 Dec. 1979
Stephan Berko May 1980 7 p refs
(Grants DAAG29-76-G-0320; DAAG29-77-G-0186)
(AD-A085301; ARO-1394.7-MS) Avail: NTIS HC A02/MF A01 CSCL 11/6

The research performed under these grants involved the development and application of the positron annihilation technique to defect studies in metals. The experiments performed during the last three years divide into three categories: (1) the study of the applicability of the simple trapping model to positron annihilation in pure lead as a function of temperature; (2) the study of vacancy-impurity interactions in Pb(Cd) and Pb(Tl) alloys, in order to test the excitonic model of 'fast diffusion' of some impurities in Pb; and (3) the design and testing of multidetector angular correlation setup to perform momentum density measurements in metals with hydrogen, in order to study the role of hydrogen in the electronic structure of pure materials. GRA

N80-28361# DyTec Engineering, Inc., Huntington Beach, Calif.
REVIEW OF TURBOFAN-ENGINE COMBUSTION AND JET-NOISE RESEARCH AND RELATED TOPICS Final Report
Alan H. Marsh and Gary L. Blankenship Jan. 1980 125 p refs
(AD-A085176; DYTEC-7936; FAA-RD-80-16) Avail: NTIS HC A06/MF A01 CSCL 21/5

In the early 1970s, internal sources of noise in jet engines were identified as being potentially strong enough to affect the levels of jet-aircraft noise at the Far Part 36 noise-certification points. These internal sources have a broadband spectrum and are not related to the rotating turbomachinery components within the engine. A review of the status of jet- and core-engine noise research was held at FAA Headquarters in the Fall of 1974. Subsequent to that status review, the FAA sponsored additional studies of combustion noise. Also, during this period, a significant study of jet noise produced by high-velocity jets was conducted under the initial sponsorship of DOT, and then of FAA. The high-velocity jet-noise study included extensive analytical and experimental investigations of jet-noise suppressors as well as studies of the effects of forward motion on jet-engine noise. In February 1977, the FAA and the DOT held a second conference at FAA Headquarters to review the status of jet- and combustion-noise research. The conference was attended by representatives from Government and industry and presentations were made of contracted and independent research studies. This report reviews the research findings presented at the February 1977 Jet/Combustion-Noise Research Conference as well as subsequent to the conference through June 1979. GRA

N80-28362# Solar Turbines International, San Diego, Calif.
DEVELOPMENT AND EVALUATION OF PROCESSES FOR DEPOSITION OF Ni/Cr-AlY (MCrAlY) COATINGS FOR GAS TURBINE COMPONENTS Final Report, 1 Nov. 1976 - 1 Sep. 1978
L. Hsu, W. G. Stevens, and A. R. Stetson Wright-Patterson AFB, Ohio AFML Sep. 1979 154 p refs
(Contract F33615-76-C-5379; AF Proj. 7312)
(AD-A085197; SR79-R-4571-18; AFML-TR-79-4097) Avail: NTIS HC A08/MF A01 CSCL 21/5

The controlled composition reaction sintered MCrAlY process was developed as a cost effective, non-line-of-sight (LOS) alternative to the physical vapor deposition (PVD) coating process. The technique was developed for coating complex clustered airfoil configurations and the mechanical, thermal shock, and environmental properties of the coatings were evaluated relative to commercially available PVD coatings. The controlled composition reaction sintered process can be either LOS or non-LOS, depending on geometry. The former consists of slurry spraying the CoNiCrAlY powder onto the cleaned part followed by reaction sintering in a controlled activity aluminized pack. The latter utilizes an electrophoretic fluidized bed approach to nickel-base alloys. Full densification of the CoNiCrAlY coating was achieved. However, the coating had greater porosity on cobalt-base X-40 alloy.
J.M.S.

N80-28363# Gates Learjet Corp., Wichita, Kans.
ENGINE INLET ANTI-ICING SYSTEM EVALUATION PROCEDURE Final Report
Allyn Heinrich, Richard Ross, and Nick Ganesan Jan. 1980 143 p refs
(Contract DOT-FA76WA-3852)
(AD-A085179; FAA-RD-80-50) Avail: NTIS HC A07/MF A01 CSCL 21/5

The objectives of this work were to develop a procedure for predicting and evaluating the performance of engine inlet anti-icing systems for compliance with FAR 25 ice protection requirements without conducting flight tests in natural icing conditions. This must include consideration of water droplet impingment, collection efficiency, internal and external heat transfer, and mass transfer of the impinging water. The method of approach for developing these procedures was to survey current analysis methods involving physical theory and empirical methods and then to develop a computerized model for use in anti-icing system performance analysis. Icing wind tunnel tests were conducted using a three dimensional nacelle test model to aid in the procedure development. A typical engine-inlet anti-icing system was evaluated with the computer model in a variety of icing environments and operational conditions and compared with icing wind tunnel test results. Correlation between performance predictions and wind tunnel test results was found to have good agreement within the spectrum of conditions that were practicable in the wind tunnel. GRA

N80-28364# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EXHAUST EMISSIONS CHARACTERISTICS FOR A GENERAL AVIATION LIGHT-AIRCRAFT AVCO LYCOMING O-320/IO-320-DIAD PISTON ENGINE Final Report
Eric E. Becker Apr. 1980 125 p refs
(FAA Proj. 201-521-100)
(AD-A084933; FAA-NA-79-45) Avail: NTIS HC A06/MF A01 CSCL 13/2

The Avco Lycoming O-320/IO-320-DIAD engine (S/N889-X) was tested at the National Aviation Facilities Experimental Center (NAFEC) to develop an exhaust emissions data base. This data base consists of current production baseline emissions characteristics, lean-out emissions data, effects of leaning-out the fuel schedule on cylinder head temperatures, and data showing ambient effects on exhaust emissions and cylinder head temperatures. The engine operating with its current full-rich production fuel schedule could not meet the proposed Environmental Protection Agency (EPA) standard for carbon monoxide (CO) under sea level standard-day conditions. The engine did, however, meet the proposed EPA standards for unburned hydrocarbons (HC) and oxides of nitrogen (NO(x)) under sea level standard-day conditions. The results of engine testing under different ambient conditions are also presented, and these results show a trend

toward higher levels of emissions output for CO and HC under warm or hot day conditions while producing slightly lower levels of NO(x). GRA

N80-28365# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.
CUMULATIVE DAMAGE FRACTURE MECHANICS UNDER ENGINE SPECTRA Final Report, 1 Sep. 1977 - 31 Jan. 1980
J. M. Larsen, B. T. Schwartz, and C. G. Annis, Jr. Jan. 1980 234 p refs
(Contract F33615-77-C-5153; AF Proj. 2420)
(AD-A084934; PWA-FR-11844; AFML-TR-79-4159) Avail: NTIS HC A11/MF A01 CSCL 21/5

An empirically based mathematical model and computer code capable of predicting cumulative damage effects on fatigue crack growth in engine disks has been developed for Waspaloy (PWA 1007) and IN100 (PWA 1073). The computing software segregates a complex loading mission, applies a multi-parameter interpolation procedure to determine cycle-by-cycle crack growth, and performs a specimen life calculation. The model was developed from a broad matrix of tests of both materials, and a number of auxiliary investigations were conducted to examine the range of applicability of the model. GRA

N80-28366# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
OVERLAY COATINGS FOR GAS TURBINE AIRFOILS
Donald H. Boone Dec. 1979 34 p refs Presented at AGARD Lectures, Lisbon, 19 Mar. 1980 and Athens, Greece and Ankara, Turkey, 19 Apr. 1980 Submitted for publication
(Contract W-7405-eng-28; DE-AC03-78ET-12293)
(LBL-10322) Avail: NTIS HC A03/MF A01

The present understanding of the degradation modes associated with gas turbine operation under a variety of conditions is reviewed as a preliminary to defining the needs of protective airfoil coatings and processing techniques. These requirements and present coating procedures are briefly described as an introduction to the need for overlay type coatings in general and electron beam (EB) evaporation processed coatings in particular. A discussion of the features of production EB coaters is followed by a detailed description of the individual coating processing steps involved. While most are identical to other coating procedures, a few are significantly different and are discussed in detail. A review of the understanding of current overlay coating compositions and their use-experience is followed by a brief discussion of future directions in overlay coating processing and compositions including electron beam physical vapor deposition (EB-PVD) applied ceramics. DOE

N80-28367# National Technical Information Service, Springfield, Va.
TURBINE BLADES: EROSION AND CORROSION. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1980
Guy E. Habercom, Jr. May 1980 191 p Supersedes NTIS/PS-79/0148; NTIS/PS-78/0144
(PB80-810112; NTIS/PS-79/0148; NTIS/PS-78/0144) Avail: NTIS HC $30.00/MF $30.00 CSCL 21E

Hostile environments to which turbine blades are exposed (i.e., liquid metals, high temperature, chemicals, etc.) are a direct cause of turbine parts erosion and/or corrosion. These Government sponsored research reports describe sources of erosion/corrosion of turbine blades and suggest methods to eliminate or alleviate the problems. This updated bibliography contains 184 abstracts, 19 of which are new entries to the previous edition. GRA

N80-28368# National Technical Information Service, Springfield, Va.
TURBINE BLADES: EROSION AND CORROSION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Feb. 1980
Guy E. Habercom, Jr. May 1980 228 p Supersedes NTIS/PS-79/0149; NTIS/PS-78/0145
(PB80-810120; NTIS/PS-79/0149; NTIS/PS-78/0145) Avail: NTIS HC $30.00/MF $30.00 CSCL 21E

Hostile environments to which turbine blades are exposed (i.e., liquid metals, high temperature, chemicals, etc.) are a direct cause of turbine parts erosion and/or corrosion. These reports, gathered in a worldwide literature survey, describe sources of erosion/corrosion of turbine blades and suggest methods to eliminate or alleviate the problems. This updated bibliography contains 221 abstracts, 26 of which are new entries to the previous edition. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-28369*# United Technologies Research Center, East Hartford, Conn.
ANALYTICAL DESIGN AND EVALUATION OF AN ACTIVE CONTROL SYSTEM FOR HELICOPTER VIBRATION REDUCTION AND GUST RESPONSE ALLEVIATION
R. B. Taylor, P. E. Zwicke, P. Gold, and W. Miao Jul. 1980 165 p refs Prepared in cooperation with Sikorsky Aircraft, Stratford, Conn.
(Contract NAS2-10121)
(NASA-CR-152377) Avail: NTIS HC A08/MF A01 CSCL 01C

An analytical study was conducted to define the basic configuration of an active control system for helicopter vibration and gust response alleviation. The study culminated in a control system design which has two separate systems: narrow band loop for vibration reduction and wider band loop for gust response alleviation. The narrow band vibration loop utilizes the standard swashplate control configuration to input controller for the vibration loop is based on adaptive optimal control theory and is designed to adapt to any flight condition including maneuvers and transients. The prime characteristics of the vibration control system is its real time capability. The gust alleviation control system studied consists of optimal sampled data feedback gains together with an optimal one-step-ahead prediction. The prediction permits the estimation of the gust disturbance which can then be used to minimize the gust effects on the helicopter. E.D.K.

N80-28370*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EXPLORATORY PILOTED SIMULATOR STUDY OF THE EFFECTS OF WINGLETS ON HANDLING QUALITIES OF A REPRESENTATIVE AGRICULTURAL AIRPLANE
Marilyn E. Ogbury and Philip W. Brown Apr. 1980 44 p refs
(NASA-TM-81817) Avail: NTIS HC A03/MF A01 CSCL 01C

The effects on handling qualities of adding winglets to a representative agricultural aircraft configuration during swath-run maneuvering were evaluated. Aerodynamic data used in the simulation were based on low-speed wind tunnel tests of a full scale airplane and a subscale model. The Cooper-Harper handling qualities rating scale, supplementary pilot comments, and pilot vehicle performance data were used to describe the handling qualities of the airplane with the different wing-tip configurations. Results showed that the lateral-directional handling qualities of the airplane were greatly affected by the application of winglets and winglet cant angle. The airplane with winglets canted out 20 deg exhibited severely degraded lateral directional handling qualities in comparison to the basic airplane. When the winglets were canted inward 10 deg, the flying qualities of the configuration were markedly improved over those of the winglet-canted-out configuration or the basic configuration without winglets, indicating that proper tailoring of the winglet design may afford a potential benefit in the area of handling qualities. L.F.M.

N80-28371*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A MATHEMATICAL REPRESENTATION OF AN ADVANCED HELICOPTER FOR PILOTED SIMULATOR INVESTIGATIONS OF CONTROL SYSTEM AND DISPLAY VARIATIONS
Edwin W. Aiken Jul. 1980 51 p refs
(NASA-TM-81203; AVRADCOM-TM-80-A-02; A-8194) Avail: NTIS HC A04/MF A01 CSCL 01C

A mathematical model of an advanced helicopter is described. The model is suitable for use in control/display research involving piloted simulation. The general design approach for the six degree of freedom equations of motion is to use the full set of nonlinear gravitational and inertial terms of the equations and to express the aerodynamic forces and moments as the reference values and first order terms of a Taylor series expansion about a reference trajectory defined as a function of longitudinal airspeed. Provisions for several different specific and generic flight control systems are included in the model. The logic required to drive various flight control and weapon delivery symbols on a pilot's electronic display is also provided. Finally, the model includes a simplified representation of low altitude wind and turbulence effects. This model was used in a piloted simulator investigation of the effects of control system and display variations for an attack helicopter mission. L.F.M.

N80-28372*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
ACTIVE DAMPING OF MODAL VIBRATIONS BY FORCE APPORTIONING Final Report, Jun. 1978 - Jun. 1980
William L. Hallauer, Jr. Jun. 1980 48 p refs
(Grant NsG-1526)
(NASA-CR-163396) Avail: NTIS HC A03/MF A01 CSCL 01C

Force apportioning, a method of active structural damping based on that used in modal vibration testing of isolating modes by multiple shaker excitation, was analyzed and numerically simulated. A distribution of as few forces as possible on the structure is chosen so as to maximally affect selected vibration modes while minimally exciting all other modes. The accuracy of numerical simulations of active damping, active damping of higher-frequency modes, and studies of imperfection sensitivity are discussed. The computer programs developed are described and possible refinements of the research are examined. A.R.H.

N80-28373*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif. Flight Research Lab.
A SUMMARY OF JOINT US-CANADIAN AUGMENTOR WING POWERED-LIFT STOL RESEARCH PROGRAMS AT THE AMES RESEARCH CENTER, NASA, 1975-1980
W. S. Hindson (National Research Council of Canada, Ottawa) and G. Hardy Jul. 1980 64 p refs Presented at Canadian Aeron. Inst. Meeting, Ottawa, 25-26 Mar. 1980
(NASA-TM-81215; LTR-FR-75) Avail: NTIS HC A04/MF A01 CSCL 01C

Several different flight research programs carried out by NASA and the Canadian Government using the Augmentor Wing Jet STOL Research Aircraft to investigate the design, operational, and systems requirements for powered-lift STOL aircraft are summarized. Some of these programs considered handling qualities and certification criteria for this class of aircraft, and addressed pilot control techniques, control system design, and improved cockpit displays for the powered-lift STOL approach configuration. Other programs involved exploiting the potential of STOL aircraft for constrained terminal-area approaches within the context of present or future air traffic control environments. Both manual and automatic flight control investigations are discussed, and an extensive bibliography of the flight programs is included. Author

N80-28374# Scientific Systems, Inc., Cambridge, Mass.
GLOBAL STABILITY AND CONTROL ANALYSIS OF AIRCRAFT AT HIGH ANGLES OF ATTACK Annual Technical Report, 1 Jun. 1978 - 31 May 1979
Raman K. Mehra and James V. Carroll Aug. 1979 348 p refs
(Contract N00014-76-C-0780)
(AD-A084938; ONR-CR-215-245-3; ATR-3) Avail: NTIS HC A15/MF A01 CSCL 20/4

High angle-of-attack phenomena have been of interest to aerodynamicists, aircraft designers, pilots and control system analysts ever since the advent of modern high performance aircraft. Due to the concentration of inertia along the fuselage, the modern jet fighters are highly susceptible to poststall departures and spin. In spite of extensive design effort, modern aircraft still inadvertently enter spins which sometimes result in loss of life and/or property. Extensive wind-tunnel testing and radio-controlled flight testing has been done over the last 20 years to gain a better understanding of the dynamic instabilities at high angles-of-attack. A basic problem has existed in interpreting these data and in making predictions of aircraft dynamic behavior so as to achieve close agreement with flight test data. Most of the work on this project involved a study of the second aircraft model, the F-4. A detailed description of modeling this aircraft, correlation time history runs, and a high angle-of-attack analysis utilizing equilibrium and bifurcation surfaces, is included in this report. The equilibrium spin regimes were found to be rather insensitive to aerosurface control deflections, a result consistent with observed performance. Studies were conducted as well in the stall/post-stall/spin entry regime, a control synthesis approach was initiated, and thrust effects were analyzed. GRA

N80-28375# Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio. Flight Control Div.
FLYING QUALITIES DESIGN REQUIREMENTS FOR SIDE-STICK CONTROLLERS Final Report, Oct. 1978 - Aug. 1979
G. Thomas Black and David J. Moorhouse Oct. 1979 186 p refs
(AF Proj. 2403)
(AD-A085085; AFFDL-TR-79-3126) Avail: NTIS HC A09/MF A01 CSCL 01/2

Five flight test experiments using the variable stability NT-33A were sponsored by AFWAL/FIGC from May 1977 to June 1979, conducted by students of the Air Force Test Pilot School. This data has been correlated with previously published flying qualities information to form guidance on design of sidestick controllers. Preferred force and deflection gradients are indicated. There is an apparent influence of short-period frequency and roll mode time constant on the preferred sidestick characteristics. The results presented and discussed are for fighter configurations and tasks. The very limited amount of data on transport airplanes is discussed. The implications to the flying qualities specification are discussed, but it is concluded that there is insufficient data to formulate requirements. Data from the AFTPS experiments is presented in appendices to this report. GRA

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

N80-28376# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
APPLICATION OF ON-LINE COMPUTER TECHNIQUES TO MEASUREMENT AND CONTROL IN A MULTIPLE-JET WIND TUNNEL
Eric Gordon Hartwell May 1980 81 p refs Sponsored by National Research Council of Canada
(UTIAS-TN-221; ISSN-0082-5263) Avail: NTIS HC A05/MF A01

The control and measurement system for a boundary layer simulation wind tunnel was automated. A digital computer was used to control the positioning of a hot wire probe in the tunnel, to measure the mean velocity, and to adjust the velocity profile by setting the flow conditions at the upstream jet grid. The use of the system was demonstrated by measuring certain aspects of the tunnel characteristics, and by automating the power law velocity profile setup procedure. E.D.K.

N80-28377*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN ASSESSMENT OF THE FUTURE ROLES OF THE NATIONAL TRANSONIC FACILITY AND THE LANGLEY TRANSONIC DYNAMICS TUNNEL IN AEROELASTIC AND UNSTEADY AERODYNAMIC TESTING
Perry W. Hanson Jun. 1980 52 p refs

(NASA-TM-81839) Avail: NTIS HC A04/MF A01 CSCL 14B

The characteristics and capabilities of the two tunnels, that relate to studies in the fields of aeroelasticity and unsteady aerodynamics are discussed. Scaling considerations for aeroelasticity and unsteady aerodynamics testing in the two facilities are reviewed, and some of the special features (or lack thereof) of the Langley Research Center Transonic Dynamics Tunnel (TDT) and the National Transonic Facility (NTF) that will weigh heavily in any decisions conducting a given study in the two tunnels are discussed. For illustrative purposes a fighter and a transport airplane are scaled for tests in the NTF and in the TDT, and the resulting model characteristics are compared. The NTF was designed specifically to meet the need for higher Reynolds number capability for flow simulation in aerodynamic performance testing of aircraft designs. However, the NTF can be a valuable tool for evaluating the severity of Reynolds number effects in the areas of dynamic aeroelasticity and unsteady aerodynamics. On the other hand, the TDT was constructed specifically for studies and tests in the field of aeroelasticity. Except for tests requiring the Reynolds number capability of NTF, the TDT will remain the primary facility for tests of dynamic aeroelasticity and unsteady aerodynamics. L.F.M.

N80-28378# Naval Postgraduate School, Monterey, Calif.
ANALYSIS AND TESTING TO IMPROVE THE FLOW FROM THE PLENUM OF A SUBSONIC CASCADE WIND TUNNEL M.S. Thesis
Richard Carl Moebius Mar. 1980 133 p refs
(AD-A084471) Avail: NTIS HC A07/MF A01 CSCL 14/2

The original design of the plenum and bellmouth contraction arrangement of a subsonic cascade test facility did not produce sufficiently uniform flow conditions at the bellmouth exit plane. Pneumatic measurements revealed sizeable blade-to-blade variations in velocity and flow angle. A finite element numerical analysis of the inviscid flow field was carried out which both confirmed the need for and guided the design of a modification to the bellmouth contraction from the plenum. Following the modifications, in which the original contraction was changed to two two dimensional contractions in series, and a program of development tests, acceptably small variations in velocity and flow angle were measured at the bellmouth exit plane. GRA

N80-28379# Seville Research Corp., Pensacola, Fla.
DEVELOPMENT OF SIMULATOR INSTRUCTIONAL FEATURE DESIGN GUIDES Interim Report
Paul W. Caro, Lawrence D. Pohlmann, and Robert N. Isley Oct. 1979 74 p refs
(Contract F49620-77-C-0112; AF Proj. 2313)
(AD-A084428; SEVILLE-TR-79-12; AFOSR-80-0345TR) Avail: NTIS HC A04/MF A01 CSCL 05/9

A project to develop guides for the design of simulator instructional features is described. Twelve instructional features, e.g., record/playback, automatic demonstration, and freeze, appropriate to a fighter/attack type aircraft simulator were identified. Information concerning each feature was obtained through observation of simulator instructional activities and review of training requirements and practices. The types of pilots likely to undergo training in a fighter/attack aircraft were examined to identify learner related simulator design requirements. A guide format was developed that would permit organization of pertinent information in a manner useful to simulator design personnel. The guides were reviewed by personnel involved in the development of both aircraft and non-aircraft simulators and were judged useful as a mechanism for clarifying design requirements, communicating between training and simulator design personnel, highlighting design shortfalls, and clarifying simulator testing requirements. GRA

N80-28380# General Applied Science Labs., Inc., Westbury, N. Y.
R2D2: A FORTRAN PROGRAM FOR TWO-DIMENSIONAL CHEMICALLY REACTING, HYPERTHERMAL, INTERNAL FLOWS. VOLUME 1: METHOD OF ANALYSIS Final Report, May 1978 - Sep. 1979
John Erdos, Gabriel Miller, Robert Ray, and Gertrude Weilerstein Wright-Patterson AFB, Ohio AFFDL Jan. 1980 50 p refs
(Contract F33615-78-C-3016; AF Proj. 2404)
(AD-A085225; GASL-TR-254-Vol-1; AFFDL-TR-79-3162-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 20/4

The theoretical formulation and method of analysis employed in the development of the FORTRAN program R2D2 is described. The program is capable of solving the two dimensional (planar or axisymmetric) internal flow of a chemically reacting and/or vibrationally excited mixture of gases in a nonequilibrium or equilibrated state. The local Mach number at the entrance and exit stations of the duct may be either subsonic or supersonic, although an arc-driven expanding flow, consisting of a subsonic reservoir, a transonic throat, and a supersonic expansion, is presumed to be the configuration of primary interest. Discontinuities in wall slope are admissible. The axisymmetric formulation includes a swirl component of velocity, in addition to the axial and radial components, which may be significant in swirl-stabilized arc facilities. The current version of R2D2 incorporates a thermochemical data package for an 8 species, 10 chemical reaction model of high temperature air, including ionization and vibrational excitation. However, the number of species and reactions is only limited by considerations of computer storage and running time, which can be formidable. GRA

N80-28381# Naval Civil Engineering Lab., Port Hueneme, Calif.
TRAFFIC TESTING OF A FIBERGLASS-REINFORCED POLYESTER RESIN SURFACING FOR RAPID RUNWAY REPAIR Final Report, Oct. 1978 - Sep. 1979
P. S. Springston Feb. 1980 44 p refs
(YF60536001)
(AD-A085288; CEL-TN-1572) Avail: NTIS HC A03/MF A01 CSCL 01/5

This report documents traffic tests of a fiberglass-reinforced polyester resin (FRP) membrane, conducted at the Rapid Runway Repair Test Facility of the Air Force Engineering and Services Center at Tyndall Air Force Base, Fla. The membrane functions primarily as a trafficable cap, preventing foreign object damage to aircraft, over a backfilled bomb crater. The membrane also reduces rutting, from rolling aircraft wheels, in a 24 in. thick crushed limestone base course overlaying backfilled debris. In the tests, applied traffic consisted of 150 and 20 coverages of load carts simulating F-4 and C-141 aircraft main gears, respectively. Experimentally recorded soil strain and surfacing deflection data are compared with predictions formulated previously, in which the finite element method of structural analysis was used. Recommendations are provided for further evaluation necessary for the certification of the concept for rapid runway repair. GRA

N80-28382# Dayton Univ., Ohio.
DESCRIPTION OF THE AFAMRL VIBRATION FACILITIES Interim Technical Report, 9 Apr. 1979 - 31 Jan. 1980
Louis A. Muhic Wright-Patterson AFB, Ohio AMRL Apr. 1980 28 p refs
(Contract F33615-79-C-0509; AF Proj. 7231)
(AD-A085164; UDR-TR-80-31; AFAMRL-TR-80-41) Avail: NTIS HC A03/MF A01 CSCL 14/2

The purpose of this report is to provide a general description and the capabilities of several unique vibration facilities located at the Biodynamic Effects Branch of the Biodynamics and Bioengineering Division of the Air Force Aerospace Medical Research Laboratory at Wright-Patterson Air Force Base, Ohio, 45433. All of these devices are currently maintained under Government contract by the University of Dayton Research Institute. This report specifically deals with the following devices: (1) SIXMODE Motion Simulator; (2) Vertical Accelerator; (3) Combined Noise and Vibration Facility; and (4) C-5 Electrodynamic Vibration System. Reference should be made to the bibliography at the end of this report for technical reports dealing with specific capabilities and examples of experiments conducted on these devices. GRA

N80-28383# Open Univ., Milton (England). Energy Research Group.
THE THIRD LONDON AIRPORT: TO BUILD OR NOT TO BUILD
David Crabbe Jul. 1979 30 p refs
(ERG-029) Avail: NTIS HC A03/MF A01; Secr. Energy Res. Group, Milton Keynes, England

A statistical analysis of London air cargo and passenger traffic, a study of previously made traffic forecasts, and an examination of existing airport capacity were made. It is concluded that the primary traffic handling problem in the area is passenger throughput, not aircraft movements. Past forecasts of airport requirements have consistently overestimated growth in passenger traffic. Economic conditions foreseen for the 1980's demand flexibility, and there is no requirement whatsoever for a third airport development plan in the London area in the foreseeable future. Author (ESA)

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N80-28384*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
ULTIMATE INTRINSIC-COERCIVITY SAMARIUM-COBALT MAGNET: AN EARTH-BASED FEASIBILITY STUDY FOR SPACE-SHUTTLE MISSIONS Technical Report, 1 Oct. 1979 - 30 Apr. 1980
Dilip K. Das, Kaplesh Kumar, Robert T. Frost (General Electric Co., Philadelphia), and C. W. Chang (General Electric Co., Philadelphia) May 1980 39 p
(Contract NAS8-33607)
(NASA-CR-161517; R-1386) Avail: NTIS HC A03/MF A01 CSCL 22A

Techniques for containerless melting and solidification of the samarium-cobalt alloy without excessive oxidation were developed. The rationale for extending these experiments in a weightless environment is also discussed. The effect of oxygen content from 0.15 to 0.63 weight percent and grain size in the range of 2 to 10 micrometers has been examined on arc-plasma-sprayed $SmCo_5$ magnets. Contrary to expectations, the larger grain sizes tended to improve the coercivities. This was attributed to an increase in homogeneity resulting from higher temperature treatments used to produce larger grain size. No significant differences in coercivity were observed on the basis of oxygen content in the range examined. It is expected that more meaningful data on the relationship between oxygen content and coercivity will be seen when the oxygen content can be lowered to less than 0.1 weight percent. A.R.H.

N80-28385*# National Aeronautics and Space Administration, Washington, D. C.
SPACE PROSPECTS
Jun. 1980 35 p refs Transl. into ENGLISH of "Prospective Spatiale", Rept. CNES, Paris, 12 Mar. 1980 p 1-30 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Centre National d'Etudes Spatiales
(Contract NASw-3199)
(NASA-TM-76228) Avail: NTIS HC A03/MF A01 CSCL 22A

A strategy for keeping the Common Market's space effort independent of and competitive with NASA and the space shuttle is discussed. Limited financing is the chief obstacle to this. Proposals include an outer space materials processing project and further development of the Ariane rocket. A manned space program is excluded for the foreseeable future. Author

N80-28386*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
A SUMMARY OF MAJOR NASA LAUNCHES, 1 OCTOBER 1958 - 31 DECEMBER 1979
Frank Jarrett Jul. 1980 201 p Revised
(NASA-TM-81106; KHR-1-Rev) Avail: NTIS HC A10/MF A01 CSCL 22A

Major NASA launches conducted under the direction of the John F. Kennedy Space Center (or its precursors) are listed within broad categories. Individual launches are summarized in chronological order under each category. The mission name, launch date/time, launch vehicle, NASA code, and site/pad are identified as well as the degree of success of the mission. A.R.H.

N80-28387# Research Inst. of National Defence, Stockholm (Sweden).
THE 175 DAYS IN SALYUT 6 AND OTHER RUSSIAN SPACE NEWS [175 DYGN I 'SALJUT-6' OCH ANDRA AKTUELLA SOVJETISKA RYMDHAENDELSER]
Astrid Rundkwist Oct. 1979 52 p refs In SWEDISH
(FOA-C-30176-F4) Avail: NTIS HC A04/MF A01

Descriptions of the activities of the two cosmonauts and the experiments they performed were taken from the Soviet press. Other Soviet space experiments are reviewed, including the satellites Ekran, Raduga, and Molniya, as well as cooperation between the Soviet Union and Sweden and India. Author (ESA)

N80-28388# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
ASTRONAUTICS: CIVILIAN AND MILITARY ACTIVITIES
Harry O. Ruppe 1979 12 p refs Presented at 30th IAF Congr., Munich, 16-22 Sep. 1979
(TUM-LRT-TB-79/4) Avail: NTIS HC A02/MF A01

The space programs of the United States and the Soviet Union are compared in terms of numbers of spacecraft launched, costs as a percentage of gross national product, absolute costs, and numbers of civilian versus military spacecraft. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-28389*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FLIGHT MECHANICS/ESTIMATION THEORY SYMPOSIUM
Arthur J. Fuchs, ed. Washington 1980 260 p refs Symp. held at Greenbelt, Md., 17-18 Oct. 1979
(NASA-CP-2123) Avail: NTIS HC A12/MF A01 CSCL 22A

Methods of determining satellite orbit and attitude parameters are considered. The Goddard Trajectory Determination System, the Global Positioning System, and the Tracking and Data Relay Satellites are among the satellite navigation systems discussed. Satellite perturbation theory, orbit/attitude determination using landmark data, and star measurements are also covered. For individual titles, see N80-28390 through N80-28401.

N80-28390*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIFFERENTIAL CORRECTION CAPABILITY OF THE GTDS USING TDRSS DATA
S. Y. Liu (Computer Sciences Corp.), D. G. Soskey (Computer Sciences Corp.), and J. Jacintho *In its* Flight Mech./Estimation Theory Symp. 1980 p 5-25 refs (For primary document see N80-28389 19-13)
(Contract NAS5-24300)
Avail: NTIS HC A12/MF A01 CSCL 22A

A differential correction (DC) capability was implemented in the Goddard Trajectory Determination System (GTDS) to process satellite tracking data acquired via the Tracking and Data Relay Satellite System (TRDRSS). Configuration of the TDRSS is reviewed, observation modeling is presented, and major features of the capability are discussed. The following types of TDRSS data can be processed by GTDS: two way relay range and Doppler measurements, hybrid relay range and Doppler measurements, one way relay Doppler measurements, and differenced one way relay Doppler measurements. These data may be combined with conventional ground based direct tracking data. By using Bayesian weighted least squares techniques, the software allows the simultaneous determination of the trajectories of up to four different satellites - one user satellite and three relay satellites. In addition to satellite trajectories, the following parameters can be optionally solved: for drag coeffcient, reflectivity of a satellite for solar radiation pressure, transponder delay, station position, and biases. J.M.S.

N80-28391*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY OF THE EFFECTS OF STATE TRANSITION

MATRIX APPROXIMATIONS

Janet A. May *In its* Flight Mech./Estimation Theory Symp. 1980 p 29-48 refs (For primary document see N80-28389 19-13)

Avail: NTIS HC A12/MF A01 CSCL 22A

The effects of using an approximate state transition matrix in orbit estimation are investigated. The approximate state transition matrix results when higher order geopotential terms in the equations of motion are ignored in the formation of the variational equations. Two methods of orbit estimation are considered: the differential correction procedure (DC) and the extended Kalman filter (EKF). The system used for the study is the Research & Development version of the Goddard Trajectory Determination System. The effects of the approximation are analyzed on a number of orbits. These orbits of various inclinations and semimajor axes. Other parameters studied include geopotential models and DC arc length. J.M.S.

N80-28392*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

TARGETING WITH FIXED PROPELLANT LOAD

Gera S. Gedeon *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 51-63 (For primary document see N80-28389 19-13)

Avail: NTIS HC A12/MF A01 CSCL 22A

The inertial upper stage (IUS) for the space shuttle operation employs solid rocket stages with fixed, propellant loadings. This means that, if for a given mission the satellite weight is less than the maximum, the IUS will deliver higher delta V's than required. One way to waste the excess capability in order to achieve the desired orbit would be to execute a nonoptimal transfer which would require higher than maximum delta V's. An algorithm is presented which defines takeoff points on the parking orbit and the injection points on the orbit for which transfer orbits require a fixed delta V sub 1 and a fixed delta V sub 2 (defined by the satellite weight). It is assumed that both the parking and the target orbit are elliptical. This allows the use of the same algorithm for guidance. The transfer orbit achieved by the erroneous delta V sub 1 is regarded as a new parking orbit and the new transfer problem is solved by assuming a delta, delta V sub 1. The maximum value of delta, delta V sub 1 is the delta V sub 1 variation and its minimum value is the one which still yields a solution by the algorithm. The delta V sub errors are regarded as orbit injection errors and compensated in the usual way. J.M.S.

N80-28393*# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.

A SEMIANALYTICAL SATELLITE THEORY FOR WEAK TIME-DEPENDENT PERTURBATIONS

P. Cefola, W. McClain, L. Early, and A. Green *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 67-91 (For primary document see N80-28389 19-13)

Avail: NTIS HC A12/MF A01 CSCL 22A

The modifications of the semianalytical satellite theory required to include these 'weak' time dependent perturbations are described. The new formulation results in additional terms in the short periodic variations but does not change the averaged equations of motion. Thus the m monthly terms are still included in the averaged equations of motion. This contrasts with the usual approach for the strongly time dependent perturbations in which the m monthly (or m daily, if tesseral harmonics are being considered) terms would be eliminated from the averaged equations of motion and included in the short periodics computation. Numerical test results for the GPS case obtained with a numerical averaging implementation of the new theory demonstrate the accuracy improvement. J.M.S.

N80-28394*# Aerospace Corp., El Segundo, Calif.

PHASE 1 NAVSTAR/GPS EPHEMERIS AND SPACE VEHICLE CLOCK PERFORMANCE SUMMARY

Albert B. Bierman *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 93-136 refs (For primary document see N80-28389 19-13)

Avail: NTIS HC A12/MF A01 CSCL 22A

The Navstar/Global Positioning System (GPS) is considered. The issue of control segment accuracy in predicting space vehicle (SV) clock and ephemeris states for broadcast to the user community is addressed. Both the highly precise ephemeris and clock prediction data blocks and the less precise (but longer period of utility) almanac data block are evaluated. J.M.S.

N80-28395*# Computer Sciences Corp., Sunnyvale, Calif.

AUTONOMOUS SATELLITE ORBIT DETERMINATION DURING THE DEVELOPMENT PHASES OF THE GLOBAL POSITIONING SYSTEM

Joan B. Dunham *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 137-156 refs (For primary document see N80-28389 19-13)

(Contract NAS5-24300)

Avail: NTIS HC A12/MF A01 CSCL 22A

An onboard navigation system was developed to aid the design and evaluation of algorithms used in autonomous satellite navigation with Global Positioning System (GPS) data. The performance of the algorithms designed for a GPS Receiver/Processor Assembly (R/PA) intended for LANDSAT-D was investigated during the development phases of the GPS (four to six satellites in the constellation). This evaluation emphasized the effects on the orbit determination accuracy of the expected user clock errors, GPS satellite visibility, force model approximations, and state and covariance propagation approximations. Results are presented giving the sensitivity of orbit determination accuracy to these constraints. Author

N80-28396*# Business and Technological Systems, Inc., Seabrook, Md.

A PRECISION RECURSIVE ESTIMATE FOR EPHEMERIS REFINEMENT (PREFER)

Bruce Gibbs *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 157-176 refs (For primary document see N80-28389 19-13)

Avail: NTIS HC A12/MF A01 CSCL 22A

A recursive filter/smoother orbit determination program was developed to refine the ephemerides produced by a batch orbit determination program (e.g., CELEST, GEODYN). The program PREFER can handle a variety of ground and satellite to satellite tracking types as well as satellite altimetry. It was tested on simulated data which contained significant modeling errors and the results clearly demonstrate the superiority of the program compared to batch estimation. J.M.S.

N80-28397*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

APPLICATION OF OPTIMUM SMOOTHING FOR IMAGE DISTORTION CORRECTION

Ronald A. Werner *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 177-198 refs (For primary document see N80-28389 19-13)

Avail: NTIS HC A12/MF A01 CSCL 22A

Optimum linear smoothing is utilized to estimate certain distortions in LANDSAT-D images. Measurements that are processed by the smoother consist of designated control of point locations within the images. Image distortions that are estimated by the smoother are those induced by LANDSAT-D satellite navigation errors and slowly varying attitude and sensor alignment uncertainties. Preliminary results indicate that optimum smoothing produces substantially more accurate distortion estimates than optimum filtering and that optimum smoothing may reduce the number of control points needed to yield desired image correction accuracy. Author

N80-28398*# Virginia Polytechnic Inst. and State Univ., Blacksburg.

OPTIMAL LARGE ANGLE MANEUVERS WITH SIMULTANEOUS SHAPE CONTROL/VIBRATION ARREST

James D. Turner and John L. Junkins *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 201-214 refs (For primary document see N80-28389 19-13)

Avail: NTIS HC A12/MF A01 CSCL 22A

A relaxation method is demonstrated which reliably solves the nonlinear two point boundary value problem which arises when optimal control theory is applied to determination of large angle maneuvers of flexible spacecraft. The basic ideas are summarized and several idealized maneuvers are determined. The emphasis is upon demonstrating the basic ideas and practical aspects of the methodology. J.M.S.

N80-28399*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ORBIT/ATTITUDE ESTIMATION FOR THE GOES SPACECRAFT USING VAS LANDMARK DATA

H. Sielski (Computer Sciences Corp.), D. Hall (Computer Sciences Corp.), R. Nankervis, and D. Koch *In its* Flight Mech./Estimation Theory Symp. 1980 p 217-249 refs (For primary document see N80-28389 19-13)

Avail: NTIS HC A12/MF A01 CSCL 22A

A software system is described which provides for batch least squares estimation of spacecraft orbit, attitude, and camera bias parameters using image data from the Geostationary Operational Environmental Satellites (GOES). The image data are obtained by the Visible and Infrared Spin Scan Radiometer (VISSR) Atmospheric Sounder (VAS). The resulting estimated parameters are used for absolute image registration. Operating in the Digital Equipment Corporation (DEC) PDP-11/70 computer, the FORTRAN system also includes the capabilities of image display and manipulations. An overview of the system is presented as well as some numerical results obtained from observations taken by the SMS-2 satellite over a 3 day interval in August 1975. Author

N80-28400*# TRW Defense and Space Systems Group, Redondo Beach, Calif.

ONBOARD IMAGE CORRECTION

D. R. Martin, A. S. Smaulon, and A. S. Hamori *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 241-250 refs (For primary document see N80-28389 19-13)

Avail: NTIS HC A12/MF A01 CSCL 22A

A processor architecture for performing onboard geometric and radiometric correction of LANDSAT imagery is described. The design uses a general purpose processor to calculate the distortion values at selected points in the image and a special purpose processor to resample (calculate distortion at each image point and interpolate the intensity) the sensor output data. A distinct special purpose processor is used for each spectral band. Because of the sensor's high output data rate, 80 M bit per second, the special purpose processors use a pipeline architecture. Sizing has been done on both the general and special purpose hardware. J.M.S.

N80-28401*# Scientific Programming and Applied Mathematics, Inc., Middleton, Wis.

INCORPORATION OF STAR MEASUREMENTS FOR THE DETERMINATION OF ORBIT AND ATTITUDE PARAMETERS OF A GEOSYNCHRONOUS SATELLITE: AN ITERATIVE APPLICATION OF LINEAR REGRESSION

Dennis Phillips *In* NASA. Goddard Space Flight Center Flight Mech./Estimation Theory Symp. 1980 p 251-261 (For primary document see N80-28389 19-13)

Avail: NTIS HC A12/MF A01 CSCL 22A

Currently on NOAA/NESS's VIRGS system at the World Weather Building star images are being ingested on a daily basis. The image coordinates of the star locations are measured and stored. Subsequently, the information is used to determine the attitude, the misalignment angles between the spin axis and the principal axis of the satellite, and the precession rate and direction. This is done for both the 'East' and 'West' operational geosynchronous satellites. This orientation information is then combined with image measurements of earth based landmarks to determine the orbit of each satellite. The method for determining the orbit is simple. For each landmark measurement one determines a nominal position vector for the satellite by extending a ray from the landmark's position towards the satellite and intersecting the ray with a sphere with center coinciding with the Earth's center and with radius equal to the nominal height for a geosynchronous satellite. The apparent motion of the satellite around the Earth's center is then approximated with a Keplerian model. In turn the variations of the satellite's height, as a function of time found by using this model, are used to redetermine the successive satellite positions by again using the Earth based landmark measurements and intersecting rays from these landmarks with the newly determined spheres. This process is performed iteratively until convergence is achieved. Only three iterations are required. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N80-28402*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

FRICTION EVALUATION OF UNPAVED, GYPSUM-SURFACE RUNWAYS AT NORTHRUP STRIP, WHITE SANDS MISSILE RANGE, IN SUPPORT OF SPACE SHUTTLE ORBITER LANDING AND RETRIEVAL OPERATIONS

Thomas J. Yager and Walter B. Horne Jun. 1980 77 p refs (NASA-TM-81811) Avail: NTIS HC A05/MF A01 CSCL 09E

Friction measurement results obtained on the gypsum surface runways at Northrup Strip, White Sands Missile Range, N. M., using an instrumented tire test vehicle and a diagonal braked vehicle, are presented. These runways were prepared to serve as backup landing and retrieval sites to the primary sites located at Dryden Flight Research Center for shuttle orbiter during initial test flights. Similar friction data obtained on paved and other unpaved surfaces was shown for comparison and to indicate that the friction capability measured on the dry gypsum surface runways is sufficient for operations with the shuttle orbiter and the Boeing 747 aircraft. Based on these ground vehicle friction measurements, estimates of shuttle orbiter and aircraft tire friction performance are presented and discussed. General observations concerning the gypsum surface characteristics are also included and several recommendations are made for improving and maintaining adequate surface friction capabilities prior to the first shuttle orbiter landing. Author

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-28403 Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Subdiv. Systemes.

DESIGN AND DESIGN VERIFICATION OF THE ARIANE LAUNCHER GUIDANCE AND CONTROL SYSTEM

Huy-Phong Nguyen Paris 1979 8 p Presented at 8th Intern. Federation of Automatic Control (IFAC) Symp. on Automatic Control in Space, Oxford, 2-6 Jul. 1979

(SNIAS-792-422-119) *Avail:* Issuing Activity

The guidance and control system of Ariane is presented including main characteristics, design goals and functional structures. Tests aimed at verifying both the ability of the design to meet the specifications and the plausibility of data on which the system's design is based are described. Author (ESA)

N80-28404*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SPACE PROCESSING APPLICATION ROCKET PROJECT, SPAR 5 Final Report

F. Reeves, comp. and D. Schaefer, comp. Aug. 1980 271 p refs

(NASA-TM-78275) Avail: NTIS HC A12/MF A01 CSCL 22B

Post flight results and analysis are presented on the following experiments: 'Agglomeration in Immiscible Liquids', 'Contained Polycrystalline Solidification in Low G', 'The Direct Observation of Dendrite Remelting and Macrosegregation in Casting', and 'Uniform Dispersion by Crystallization'. An engineering report on the performance of the SPAR Black Brant rocket is also included. Much useful data and information were accumulated for directing and developing experimental techniques and investigations toward

an expanding commercially beneficial program of materials processing in the coming shuttle era. L.F.M.

N80-28405*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ATTITUDE STABILITY OF SPINNING SATELLITES
T. K. Caughey 15 Jul. 1980 67 p refs
(Contract NAS7-100)
(NASA-CR-163364; JPL-Pub-80-46) Avail: NTIS
HC A04/MF A01 CSCL 22B

Some problems of attitude stability of spinning satellites are treated in a rigorous manner. With certain restrictions, linearized stability analysis correctly predicts the attitude stability of spinning satellites, even in the critical cases of the Liapunov-Poincare stability theory. L.F.M.

N80-28406*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
LSST SYSTEM ANALYSIS AND INTEGRATION TASK FOR AN ADVANCED SCIENCE AND APPLICATION SPACE PLATFORM Final Report
Jul. 1980 112 p refs
(Contract NAS8-33592)
(NASA-CR-161528; MDC-G8533) Avail: NTIS
HC A06/MF A01 CSCL 22B

To support the development of an advanced science and application space platform (ASASP) requirements of a representative set of payloads requiring large separation distances selected from the Science and Applications Space Platform data base. These payloads were a 100 meter diameter atmospheric gravity wave antenna, a 100 meter by 100 meter particle beam injection experiment, a 2 meter diameter, 18 meter long astrometric telescope, and a 15 meter diameter, 35 meter long large ambient deployable IR telescope. A low earth orbit at 500 km altitude and 56 deg inclination was selected as being the best compromise for meeting payload requirements. Platform subsystems were defined which would support the payload requirements and a physical platform concept was developed. Structural system requirements which included utilities accommodation, interface requirements, and platform strength and stiffness requirements were developed. An attitude control system concept was also described. The resultant ASASP concept was analyzed and technological developments deemed necessary in the area of large space systems were recommended. A.R.H.

N80-28407# Ballistic Research Labs., Aberdeen Proving Ground, Md.
SYMMETRIC MISSILE DYNAMIC INSTABILITIES: A REVIEW Final Report
Charles H. Murphy Mar. 1980 42 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A085022; AD-E400440; ARBRL-TR-02228) Avail: NTIS
HC A03/MF A01 CSCL 16/2

Dynamic instabilities observed for symmetric missiles and projectiles arise from a large variety of causes. These include unstable linear damping moments, and different nonlinear in-plane and out-of-plane damping moments for nonspinning re-entry vehicles, nonlinear Magnus moments for spinning missiles, and internal resonance with moving payload components. If aerodynamic trim is present, linear spin-yaw resonance can occur as well as nonlinear subharmonic motions and a number of other limit motions. This report gives a complete survey of these possibilities with a number of actual case histories. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also 03 Air Transportation and Safety and 85 Urban Technology and Transportation.

N80-28408*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MCC LEVEL C FORMULATION REQUIREMENTS. SHUTTLE TAEM GUIDANCE AND FLIGHT CONTROL, STS-1 BASELINE
Gilbert L. Carman and Moises N. Montez Jun. 1980 85 p
ref Supersedes JSC-11786
(NASA-TM-81100; JSC-16523; JSC-11786) Avail: NTIS
HC A06/MF A01 CSCL 22B

The TAEM guidance and body rotational dynamics models required for the MCC simulation of the TAEM mission phase are defined. This simulation begins at the end of the entry phase and terminates at TAEM autoland interface. The logic presented is the required configuration for the first shuttle orbital flight (STS-1). The TAEM guidance is simulated in detail. The rotational dynamics simulation is a simplified model that assumes that the commanded rotational rates can be achieved in the integration interval. Thus, the rotational dynamics simulation is essentially a simulation of the autopilot commanded rates and integration of these rates to determine orbiter attitude. The rotational dynamics simulation also includes a simulation of the speedbrake deflection. The body flap and elevon deflections are computed in the orbiter aerodynamic simulation. A.R.H.

N80-28409*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
STS-1 OPERATIONAL FLIGHT PROFILE. VOLUME 5: DESCENT CYCLE 3. APPENDIX D: GRTLS SIX DEGREE OF FREEDOM MONTE CARLO DISPERSION ANALYSIS
Moises N. Montez Jul. 1980 120 p refs
(NASA-TM-81101; JSC-14483-App-D;
Rept-78-FM-51-Vol-5-App-D) Avail: NTIS HC A06/MF A01
CSCL 22A

The results of a six degree of freedom (6-DOF) nonlinear Monte Carlo dispersion analysis for the latest glide return to landing site (GRTLS) abort trajectory for the Space Transportation System 1 Flight are presented. For this GRTLS, the number two main engine fails at 262.5 seconds ground elapsed time. Fifty randomly selected simulations, initialized at external tank separation, are analyzed. The initial covariance matrix is a 20 x 20 matrix and includes navigation errors and dispersions in position and velocity, time, accelerometer bias, and inertial platform misalinements. In all 50 samples, speedbrake, rudder, elevon, and body flap hinge moments are acceptable. Transitions to autoland begin before 9,000 feet and there are no tailscrapes. Navigation derived dynamic pressure accuracies exceed the flight control system constraints above Mach 2.5. Three out of 50 landings exceeded tire specification limit speed of 222 knots. Pilot manual landings are expected to reduce landing speed by landing farther downrange. L.F.M.

N80-28410*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PLAID EVALUATION OF VISUAL ACCESS FOR PDP BERTHING AND DEPLOYMENT
Jeri W. Brown Apr. 1980 45 p
(NASA-TM-81102; JSC-16653) Avail: NTIS
HC A03/MF A01 CSCL 22A

Tests were performed to evaluate visual access for berthing and deployment of the Plasma Diagnostic Package (PDP) in Space Transportation 4 Flight (STS-4). The Panel Layout Automated Interactive Design (PLAID), a 3 D computer graphics package, was used to construct models of the PDP, pallet, orbiter payload bay, the Remote Manipulator System (RMS), and other relevant elements to represent the STS-4 configuration. Several different assemblies were made, each one representing a snapshot of the PDP during berth/deploy maneuvers. Thirty-six views were produced during this test. L.F.M.

N80-28411*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PROXIMITY OPERATIONS ANALYSIS: RETRIEVAL OF THE SOLAR MAXIMUM MISSION OBSERVATORY
Jerry A. Yglesias (McDonnell Douglas Technical Services Co., Inc., Houston) Apr. 1980 41 p refs
(NASA-TM-81104; JSC-16411) Avail: NTIS
HC A03/MF A01 CSCL 22A

Retrieval of the solar maximum mission (SMM) observatory is feasible in terms of orbiter primary reaction control system (PRCS) plume disturbance of the SMM, orbiter propellant consumed, and flight time required. Man-in-loop simulations will be required to validate these operational techniques before the verification process is complete. Candidate approach and flyaround

techniques were developed that allow the orbiter to attain the proper alinement with the SMM for clear access to the grapple fixture (GF) prior grappling. Because the SMM has very little control authority (approximately 14.8 pound-foot-seconds in two axes and rate-damped in the third) it is necessary to inhibit all +Z (upfiring) PRCS jets on the orbiter to avoid tumbling the SMM. A profile involving a V-bar approach and an out-of-plane flyaround appears to be the best choice and is recommended at this time. The flyaround technique consists of alining the +X-axes of the two vehicles parallel with each other and then flying the orbiter around the SMM until the GF is in view. The out-of-plane flyaround technique is applicable to any inertially stabilized payload, and the entire final approach profile could be considered as standard for most retrieval missions. L.F.M.

N80-28412*# IBM Federal Systems Div., Houston, Texas.
FLIGHT SOFTWARE MEMORY SIZING AND CPU LOADING ESTIMATES
May 1980 12 p refs
(Contract NAS9-14444)
(NASA-CR-160732) Avail: NTIS HC A02/MF A01 CSCL 09B

Estimates of the AP101 memory and central processing unit (CPU) requirements for the space shuttle orbiter are presented. The resource estimates reflect OASCAB approved change requests for Release 18 and Release 19. Memory sizes are presented in 32 bit full words. CPU loading is listed by percentage. Memory and CPU information was obtained from actual AP101 code where available, and from estimates provided by flight software development programmers. L.F.M.

N80-28413*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A SURVEY OF LOAD METHODOLOGIES FOR SHUTTLE ORBITER PAYLOADS
J. C. Chen, J. A. Garba, M. Salama, and M. Trubert 15 Jun. 1980 105 p refs
(Contract NAS7-100)
(NASA-CR-163361; JPL-Pub-80-37) Avail: NTIS HC A06/MF A01 CSCL 22B

Loads methods currently being used to design shuttle orbiter payloads are summarized. Methods used for the design of payloads launched by expendable launch vehicles are described in historical perspective. Experiences gained from expendable launch vehicle payloads are used to develop methodologies for the space shuttle orbiter payloads. The objectives for the development of a new methodology for the shuttle payloads are to reduce the cost and schedule for the payload load analysis by decoupling the payload analysis from the launch vehicle to the maximum extent possible. Methods are described for payload member load estimation or obtaining upper bounds for dynamic loads, as well as load prediction or calculating actual transient member load time histories. Author

N80-28414*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
POWER SYSTEM INTERFACE AND UMBILICAL SYSTEM STUDY Final Report
7 Jul. 1980 112 p refs
(Contract NAS8-33707)
(NASA-CR-161521; LMSC-D758183) Avail: NTIS HC A06/MF A01 CSCL 22B

System requirements and basic design criteria were defined for berthing or docking a payload to the 25 kW power module which will provide electrical power and attitude control, cooling, data transfer, and communication services to free-flying and Orbiter sortie payloads. The selected umbilical system concept consists of four assemblies and command and display equipment to be installed at the Orbiter payload specialist station: (1) a movable platen assembly which is attached to the power system with EVA operable devices; (2) a slave platen assembly which is attached to the payload with EVA operable devices; (3) a fixed secondary platen permanently installed in the power system; and (4) a fixed secondary platen permanently installed on the payload. Operating modes and sequences are described. A.R.H.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also 04 Aircraft Communications and Navigation and 32 Communications.

N80-28415*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBIT IMU ALIGNMENT: ERROR ANALYSIS
R. W. Corson Aug. 1980 42 p
(NASA-TM-81030; JSC-16758; Rept-80-FM-39) Avail: NTIS HC A03/MF A01 CSCL 20A

A comprehensive accuracy analysis of orbit inertial measurement unit (IMU) alignments using the shuttle star trackers was completed and the results are presented. Monte Carlo techniques were used in a computer simulation of the IMU alignment hardware and software systems to: (1) determine the expected Space Transportation System 1 Flight (STS-1) manual mode IMU alignment accuracy; (2) investigate the accuracy of alignments in later shuttle flights when the automatic mode of star acquisition may be used; and (3) verify that an analytical model previously used for estimating the alignment error is a valid model. The analysis results do not differ significantly from expectations. The standard deviation in the IMU alignment error for STS-1 alignments was determined to the 68 arc seconds per axis. This corresponds to a 99.7% probability that the magnitude of the total alignment error is less than 258 arc seconds. Author

N80-28416# Air Force Geophysics Lab., Hanscom AFB, Mass. Aerospace Instrumentation Div.
AFGL BALLOON TELEMETRY FACILITY Instrumentation Papers. Final Report
Arthur A. Giannetti and J. Craig Erickson 23 Jan. 1980 24 p (AF Proj. 6665)
(AD-A084811; AFGL-TR-80-0029; AFGL-IP-284) Avail: NTIS HC A02/MF A01 CSCL 09/6

This paper describes the recently modernized permanent and mobile facilities for recovering and processing PCM and FM telemetry data from balloon-borne scientific experiments and engineering tests at Air Force Geophysics Laboratory, Detachment 1, Holloman Air Force Base, New Mexico. Mobile units are run either as stand-alone ground stations for launches from remote launch sites, or with telephone communications link to extend the operable range from the permanent ground station on Holloman AFB. GRA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-28417*# Lockheed Aircraft Corp., Palo Alto, Calif.
GYRODAMPERS FOR LARGE SPACE STRUCTURES
J. N. Aubrun and G. Margulies Feb. 1979 107 p refs
(Contract NAS1-14887)
(NASA-CR-159171) Avail: NTIS HC A06/MF A01 CSCL 22B

The problem of controlling the vibrations of a large space structures by the use of actively augmented damping devices distributed throughout the structure is addressed. The gyrodamper which consists of a set of single gimbal control moment gyros which are actively controlled to extract the structural vibratory energy through the local rotational deformations of the structure, is described and analyzed. Various linear and nonlinear dynamic simulations of gyrodamped beams are shown, including results

on self-induced vibrations due to sensor noise and rotor imbalance. The complete nonlinear dynamic equations are included. The problem of designing and sizing a system of gyrodampers for a given structure, or extrapolating results for one gyrodamped structure to another is solved in terms of scaling laws. Novel scaling laws for gyro systems are derived, based upon fundamental physical principles, and various examples are given. A.R.H.

N80-28418*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN ASSESSMENT OF THE READINESS OF ABLATIVE MATERIALS FOR PREFLIGHT APPLICATION TO THE SHUTTLE ORBITER
Stephen S. Tompkins, William D. Brewer, Ronald K. Clark, Claud M. Pittman, and Kay L. Brinkley Jul. 1980 62 p refs
(NASA-TM-81823) Avail: NTIS HC A04/MF A01 CSCL 22B

The shuttle orbiter relies primarily on a reusable surface insulation (RSI) thermal protection system (TPS). The RSI is very efficient in its thermal performance; however, the RSI tile system has shown poor mechanical integrity. The state-of-the-art of the ablative TPS is reviewed, and an assessment made of the ablator's readiness for use on the shuttle orbiter. Unresolved technical issues with regard to the ablative TPS are identified. Short time, highly focused analytical and experimental programs were initiated to: (1) identify candidate ablation materials; (2) assess the data base for these materials; (3) evaluate the need and kind of waterproof coating; (4) calculate thermal and other stresses in an ablator tile; (5) identify an acceptable ablator/RSI tile joint filler; and (6) assess the sensitivity of the ablator to sequential heat pulses. Results from some of these programs are discussed. L.F.M.

N80-28419# Aerospace Corp., El Segundo, Calif. Engineering Group.
PROCEEDINGS OF SYMPOSIUM ON WIRE APPLICATIONS IN SPACECRAFT Final Report
Syed M. Alvi and Leonard Katzin Dec. 1979 338 p refs Conf. held in Los Angeles, 8-9 May 1979
(Contract F04701-79-C-0080)
(AD-A084525; TR-0080(5902-04)-1; SD-TR-80-20) Avail: NTIS HC A15/MF A01 CSCL 09/1

Hundreds of pounds of wire are used in a spacecraft and this wire is installed into the product almost exclusively by human hands. As such, workmanship is as important as the modern technological advances in materials processes and engineering in wiring a product. These proceedings present a large variety of papers covering almost every aspect of importance to spacecraft wiring. The symposium format was tutorial, and each paper was written as somewhat of a text of its respective subject. The papers can be grouped into the following subjects: Specifications; Testing of wires; Wire preparation; Cables and harnesses; Wire-wound components; Wire joining techniques; Interconnection techniques; Rework and repair techniques; Design considerations; and New concepts and needs. GRA

N80-28420# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
THE DYNAMICS OF RIGID BODY IN THE SPACE PLASMA Environmental Research Papers
Peter J. L. Wildman 28 Aug. 1979 36 p refs Submitted for publication
(AF Proj. 2311; AF Proj. 7661)
(AD-A084806; AFGL-TR-79-0201; AFGL-ERP-673) Avail: NTIS HC A03/MF A01 CSCL 22/3

A time-dependent technique, in conjunction with the boundary-fitted coordinates system, is applied to solve a gas-only one-phase flow and a fully-coupled, gas-particle two-phase flow inside nozzles with small throat radii of curvature, steep wall gradients, and submerged configurations. The emphasis of the study has been placed on one- and two-phase flow in the transonic region. Various particle size and particle mass fractions have been investigated in the two-phase flow. The salient features associated with the two-phase nozzle flow compared with those of the one-phase flow are illustrated through the calculations for a JPL nozzle configuration, for the Titan III solid rocket motor nozzle, and for the submerged nozzle configuration utilized in the Inertial Upper Stage (IUS) solid rocket motor. GRA

N80-28421# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
CHARGING OF A SPINNING SPACECRAFT Environmental Research Papers
A. G. Rubin and K. H. Bhavnavi 29 Oct. 1979 17 p refs
(AF Proj. 7661)
(AD-A084807; AFGL-TR-79-0261; AFGL-ERP-682) Avail: NTIS HC A02/MF A01 CSCL 22/3

It has become possible to calculate the effects of spin rate on charging only since the advent of the NASCAP three dimensional computer simulation code. These spin effects are surveyed here for the first time. There is not only a dramatic difference in potential distribution between a three-axis stabilized and a spinning satellite, but also the case of slow spin at 1 rpm is shown to constitute a distinct intermediate case, asymptotic to the rapid spin case but with appreciable voltage modulation around the spin equator. GRA

N80-28422# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
LARGE SPACE STRUCTURE CHARGING DURING ECLIPSE PASSAGE Air Force Surveys in Geophysics
David M. Gauntt 15 Jan. 1980 39 p refs
(AF Proj. 7661)
(AD-A084810; AFGL-TR-80-0022; AFGL-AFSG-420) Avail: NTIS HC A03/MF A01 CSCL 22/3

Much work has been developed to the study of the differential charging of geosynchronous spacecraft, primarily that charging caused by injection events and uneven illumination of isolated surfaces. However, as the lack of illumination in the penumbra eliminates the latter problem, little attention has been paid to charging during eclipse passage. For a sufficiently large structure (length greater than 1 km), the gradient of illumination in the penumbra is large enough to contribute significantly to differential charging. In this paper, three main subjects will be discussed: (1) the causes of charging at geosynchronous altitudes; (2) a simple model of the plasma from which the differential charging equations can be derived; and (3) the results of a computer program based on these equations, together with several theoretically fit sets of equations to approximate the results. GRA

N80-28423# Parker (Lee W.), Inc., Concord, Mass.
TIME-DEPENDENT COMPUTER MODEL OF PLASMA SPACE CHARGE INTERACTIONS WITH A FINITE-CYLINDRICAL SPACECRAFT Final Report, 1 Apr. 1978 - 30 Sep. 1979
Lee W. Parker 31 Dec. 1979 88 p
(Contract F19628-78-C-0149; AF Proj. 7661)
(AD-A084892; AFGL-TR-80-0018) Avail: NTIS HC A05/MF A01 CSCL 09/2

A computer program has been developed for the study of the time-dependent behavior of the sheaths and charging effects of spacecraft with finite-cylinder ('pillbox') geometry. The behavior of ions and electrons is simulated by following representative computer particles in time. During each time step the particles are moved, their space charge is computed, and the electric potential distribution is updated. The development is original. A number of sample runs show that current collection and space charge behavior can be computed as functions of time. GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-28424*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE TIME-SPACE RELATIONSHIP OF THE DATA POINT (PIXELS) OF THE THEMATIC MAPPER AND MULTISPECTRAL SCANNER OR THE MYTH OF SIMULTANEITY

Frederick Gordon, Jr. Jul. 1980 29 p refs
(NASA-TP-1715; Rept-80F5121) Avail: NTIS HC A03/MF A01 CSCL 14B

A simplified explanation of the time space relationships among scanner pixels is presented. The examples of the multispectral scanner (MSS) on Landsats 1, 2, and 3 and the thematic mapper (TM) of Landsat D are used to describe the concept and degree of nonsimultaneity of scanning system data. The time aspects of scanner data acquisition and those parts of the MSS and TM systems related to that phenomena are addressed. E.D.K.

N80-28425*# Sperry Flight Systems, Phoenix, Ariz.
LABORATORY EVALUATION OF THE POINTING STABILITY OF THE ASPS VERNIER SYSTEM
Jun. 1980 66 p
(Contract NAS1-15008)
(NASA-CR-159307; Rept-5121.5869.6.1-5) Avail: NTIS HC A04/MF A01 CSCL 14B

The annular suspension and pointing system (ASPS) is an end-mount experiment pointing system designed for use in the space shuttle. The results of the ASPS Vernier System (AVS) pointing stability tests conducted in a laboratory environment are documented. A simulated zero-G suspension was used to support the test payload in the laboratory. The AVS and the suspension were modelled and incorporated into a simulation of the laboratory test. Error sources were identified and pointing stability sensitivities were determined via simulation. Statistical predictions of laboratory test performance were derived and compared to actual laboratory test results. The predicted mean pointing stability during simulated shuttle disturbances was 1.22 arc seconds; the actual mean laboratory test pointing stability was 1.36 arc seconds. The successful prediction of laboratory test results provides increased confidence in the analytical understanding of the AVS magnetic bearing technology and allows confident prediction of in-flight performance. Computer simulations of ASPS, operating in the shuttle disturbance environment, predict in-flight pointing stability errors less than 0.01 arc seconds.
Author

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-28426*# Battelle Columbus Labs., Ohio.
EVALUATION OF SPACE SHUTTLE MAIN ENGINE BEARINGS FROM HIGH PRESSURE OXYGEN TURBOPUMP 9008 Final Report
K. F. Dufrane and J. W. Kannel 11 Jul. 1980 32 p refs
(Contract NAS8-33576)
(NASA-CR-161516) Avail: NTIS HC A03/MF A01 CSCL 21H

Two used turbopump mainshaft support bearings were examined to determine steps needed to achieve turbopump lifetimes of 27,000 seconds. The two bearings, which had been run in a high pressure oxygen turbopump, are angular contact ball bearings, applied as a preloaded pair, locked to the shaft, inner race rotating, with the outer races unrestrained axially. Examination showed that both bearings had been subjected to overloads, leading to fatigue spalling on the races and balls and advanced retainer wear. This is clear evidence of unintended high internal loads in the high pressure oxygen pump which would lead to complete bearing failure and extensive secondary pump damage. Action must be taken to reduce the applied bearing loads or to incorporate bearings of sufficient size to withstand the high loads. L.F.M.

N80-28427*# Rocketdyne, Canoga Park, Calif.
ORBIT TRANSFER VEHICLE ENGINE STUDY, PHASE A EXTENSION. VOLUME 1: EXECUTIVE SUMMARY Final Report
30 Jun. 1980 61 p 3 Vol.
(Contract NAS8-32996)
(NASA-CR-161514; RI/RD80-155-1-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 21H

A 1980 state-of-the-art advanced expander engine was configured that delivers near-optimum payload-performance and exhibits the simplicity reliability, and life characteristics required of the OTV mission. Engine optimization studies indicate that the performance of the conventional expander cycle engine can be improved substantially through combustion chamber surface area enhancement, thermal enhancement, turbine regeneration, and power cycle efficiency enhancement procedures. The 20K lb. thrust staged combustion engine can be adapted to operate at extended periods in the 1 to 2K lb. thrust regime. The study results indicate that long-life, high performnce operation in the low thrust mode can be achieved with minimum modifications (kitting) of the engine. Although the main contribution to mission success and crew safety stems from propulsion system redundancy, significant reliability can be gained from engine component redundancy, specific engine design features ensuring safety and reliability, including an engine health monitoring system, and from a total program approach to safety and reliability, such as that presently applied to the space shuttle. A.R.H.

N80-28428*# Rocketdyne, Canoga Park, Calif.
ORBIT TRANSFER VEHICLE ENGINE STUDY, PHASE A EXTENSION. VOLUME 2A: STUDY RESULTS Final Report
30 Jun. 1980 213 p refs 3 Vol.
(Contract NAS8-32996)
(NASA-CR-161515; RI/RD80-155-2-Vol-2-A) Avail: NTIS HC A10/MF A01 CSCL 21H

Engine trade studies and systems analyses leading to a baseline engine selection for advanced expander cycle engine are discussed with emphasis on: (1) performance optimization of advanced expander cycle engines in the 10 to 20K pound thrust range; (2) selection of a recommended advanced expander engine configuration based on maximized performance and minimized mission risk, and definition of the components for this configuration; (3) characterization of the low thrust adaptation requirements and performance for the staged combustion engine; (4) generation of a suggested safety and reliability approach for OTV engines independent of engine cycle; (5) definition of program risk relationships between expander and staged combustion cycle engines; and (6) development of schedules and costs for the DDT&E, production, and operation phases of the 10K pound thrust expander engine program.
A.R.H.

N80-28429*# Aerojet Liquid Rocket Co., Sacramento, Calif.
DUAL NOZZLE AERODYNAMIC AND COOLING ANALYSIS STUDY Monthly Progress Report, 1 May - 30 Jun. 1980
G. M. Meagher 10 Jul. 1980 25 p ref
(Contract NAS8-33553)
(NASA-CR-161525; BMPR-33553-M-10) Avail: NTIS HC A02/MF A01 CSCL 21H

Geometric, aerodynamic flow field, performance prediction, and heat transfer analyses are considered for two advanced chamber nozzle concepts applicable to Earth-to-orbit engine systems. Topics covered include improvements to the dual throat aerodynamic and performance prediction program; geometric and flow field analyses of the dual expander concept; heat transfer analysis of both concepts, and engineering analysis of data from the NASA/MSFC hot-fire testing of a dual throat thruster model thrust chamber assembly. Preliminary results obtained are presented in graphs. A.R.H.

N80-28430# Northeastern Univ., Boston, Mass. Electronics Research Lab.
COMMAND CONTROL CONSOLES FOR SOUNDING ROCKET PAYLOADS Interim Report
Richard L. Morin Dec. 1979 24 p refs
(Contract F19628-76-C-0152; AF Proj. 2123)
(AD-A084097; SCIENTIFIC-3; AFGL-TR-80-0019) Avail: NTIS HC A02/MF A01 CSCL 17/2

Presented is a summary of the design and development of a command control system. The objective is a real-time command and monitor console for payload functions in sounding rockets.

Payload requirements, console configurations, ground support interfaces, and test results for a specific experimental payload application are described in this report. GRA

N80-28431# ARO, Inc., Arnold Air Force Station, Tenn.
ANALYSIS OF CRYODEPOSIT MIXTURES Final Report, 1 Oct. 1977 - 1 Sep. 1979
K. F. Palmer, J. A. Roux, and B. E. Wood AEDC, Arnold AFS, Tenn. May 1980 30 p refs
(AD-A084548; AEDC-TR-79-80) Avail: NTIS HC A03/MF A01 CSCL 20/6

This work was concerned with the infrared (IR) spectroscopic analysis of the optical properties of cryodeposits and other materials that are important in plume contamination and related studies. The assumption that IR-active molecular band strengths in a material are directly proportional to molecular band species concentrations is incorporated in a method for the calculation of species mole fractions, which is presented along with the results of an analysis of existing AEDC cryodeposit data. The agreement of the calculated mole fractions with those obtained from chemical analysis was within 15 percent for binary component cryodeposits, but much worse for multicomponent cryodeposits. During the search for an explanation of the discrepancies, it was found that the accuracies of the densities of the cryodeposits were as crucial as those of the band strengths, and that the above assumption must be modified, in a yet unknown manner, for materials where there is a large degree of hydrogen bonding. Also, it was noted that in mole fraction determinations the use of absorption index values alone is limited to materials having at most one IR-inactive molecular species. However, the identity of IR-inactive species, which must be known in the calculation, must be available from techniques other than IR spectroscopy. A method using molar refractivities for analyzing materials with two or more IR-inactive species is outlined. GRA

N80-28432# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.
FREE AIR FLUME OVERPRESSURE FOR 2.75 INCH ROCKET MOTORS MARK 40 AND MARK 66
Robert Bergman and Donald Davis 13 Mar. 1980 22 p
(AD-A084478; DRSMI/RL-80-8) Avail: NTIS HC A02/MF A01 CSCL 19/7

Testing was conducted to determine the free air blast overpressure of the 2.75 inch rocket motors MARK 40 and MARK 66. Data were collected for single and ripple firings of both type of rockets. 'Pressure maps' were generated to display the results. GRA

N80-28433# Army Natick Research and Development Command, Mass.
RETROROCKET SOFT LANDING OF AIRDROPPED CARGO Technical Progress Report, Oct. 1978 - Oct. 1979
William R. Nykvist Dec. 1979 70 p refs
(DA Proj. 1L1-62210-D-283)
(AD-A085220; Natick/TR-80/011) Avail: NTIS HC A04/MF A01 CSCL 01/3

A retrorocket soft landing system for airdropped cargo is described and mathematically analyzed. Solid propellant rockets and fixed height ground sensing, previously used in the experimental Parachute Retrorocket Airdrop System (PRADS), are assumed for this system. Seventeen variables affecting the load impact velocity are defined and used to write the one-body equations of motion for the system. A computer is used to generate 500 constrained random values for each independent variable, to calculate the impact velocity for 500 cases by solving the equations of motion, and to statistically analyze the results. It is concluded that 95% of the soft landings can be expected to have impact velocities between 2.0 and 3.4 m/s (6.1 and 10.3 ft/s). GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-28434# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
KINETICS AND MECHANISM OF METAL-CARBONYL-CATALYZED HYDROGENATION OF AROMATIC HYDROCARBON MODELS FOR COAL CONSTITUENTS Ph.D. Thesis
Tibor T. Derencsenyi and Theodore Vermeulen Sep. 1979 231 p refs
(Contract W-7405-eng-48)
(LBL-9777) Avail: NTIS HC A11/MF A01

Homogeneous catalytic hydrogenation of anthracene by Mn2(CO)8(PBu3)2 and cyclohexene by RhCl(PPh3)3 were studied, and mechanisms for both reactions are presented. The manganese operates by two competing steps, the formation of a trihydride and an anthracene-manganese complex reacting to produce 9,10-dihydroanthracene, whereas the rhodium forms a dihydride-olefine-rhodium complex whose decomposition is the rate determining step. Substitution of the phosphine ligands on Mn2(CO)8(PBu3)2 show that the rate of anthracene hydrogenation is dependent on the nature of the ligand. The rate did not correlate with the basicity of the phosphine, but additivity effects were noted which led to an excellent correlation of the rate with P-31 NMR shift of the phosphine oxide. This correlation is shown to be a novel linear free-energy relationship that may be extended to other metal complexes for the purposes of describing catalytic activity and the mechanistic details of reactions, such as oxidative addition of hydrogen, cis-trans equilibrium, and ligand exchange. DOE

N80-28435# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
ELECTRON OXIDATION OF AROMATIC MOLECULES AND RELATED DELOCALIZED ELECTRON SOLIDS
Francis Louis Tanzella Jan. 1980 108 p refs
(Contract W-7405-eng-48)
(LBL-10478) Avail: NTIS HC A06/MF A01

Pyrolysis of C6F6AsF6, C5F5NAsF6 and CF3C6F5AsF6 yields an equimolar mixture of the parent fluorocarbon and an isomer specific cyclohexadiene. A mechanism for this decomposition involving F(-) transfer from anion to cation is discussed. Hydrolysis of C10F6AsF6 yields an equimolar mixture of C10F8 and an isomer specific quinone C10F6O2. Mechanism involving OH(-) attack on the cation is presented. Benzene reacts with AsF5 to give (C6H5)2AsF2(+)AsF6(-) which then reacts quantitatively with CsF to give (C6H5)2AsF3 and CsAsF6. Interaction of (C6H5)2AsF3 with AsF5 reconstitutes the fluoroarsonium salt. Variable temperature 19FNMR studies show phi2AsF3 to be a rigid trigonal bipyramid, with the phenyl groups in equatorial positions, to 71 C. Interaction of benzene with O2AsF6 or C6F6AsF6 yields a mixture of (C6H5)2AsF2(+)AsF6(-) and a poly(p-phenylene) salt. A mechanism involving initial electron oxidation of benzene to give the radical cation intermediate C6H6(+)AsF6(-) is proposed. The moderate electrical conductivity of the polyphenylene salt indicates that it is a delocalized electron solid. DOE

24 COMPOSITE MATERIALS

Includes laminates.

N80-28436*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SELECTED NASA RESEARCH IN COMPOSITE MATERIALS AND STRUCTURES
1980 237 p refs Presented at the 2d Ind. Rev. of the NASA Aircraft Energy Efficiency (ACEE) Composite Programs, Seattle, 11-13 Aug. 1980
(NASA-CP-2142; L-13915) Avail: NTIS HC A15/MF A01 CSCL 11D

Various aspects of the application of composite materials to aircraft structures are considered. Failure prediction techniques, buckling and postbuckling research, laminate fatigue analysis, damage tolerance, high temperature resin matrix composites and electrical hazards of carbon fiber composites are among the topics discussed. For individual titles, see N80-28437 through N80-28442.

N80-28437*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FAILURE PREDICTION TECHNIQUES FOR COMPRESSION LOADED COMPOSITE LAMINATES WITH HOLES
Martin M. Mikulas, Jr. *In its* Selected NASA Res. in Composite Mater. and Struct. 1980 p 1-33 refs (For primary document see N80-28436 19-24)
Avail: NTIS HC A15/MF A01 CSCL 11D

The degree of notch sensitivity of composites in compression and whether their failures can be predicted over a wide range of plate and hole sizes. The notch sensitivity of composites is investigated by comparing actual failure loads of laminates with circular holes, with the extreme failure that would be expected from an ideal notch insensitive material and from an ideal notch sensitive material. The predictability question is addressed by applying the point stress failure criterion to a wide range of plate widths and hole sizes and comparing with available experimental data. The severity of impact is explored by comparing strength reductions resulting from impact with those resulting from comparable size circular holes. Finally, comparison is made of the differences to be expected from the effects of cracks and circular holes on failure strength. J.M.S.

N80-28438*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
BUCKLING AND POSTBUCKLING RESEARCH ON FLAT AND CURVED COMPOSITE PANELS
James H. Starnes, Jr. *In its* Selected NASA Res. in Composite Mater. and Struct. 1980 p 35-78 refs (For primary document see N80-28436 19-24)
Avail: NTIS HC A15/MF A01 CSCL 11D

Progress in the development of verified design technology for generic advanced-composite structural components loaded in compression is reported. Generic structural configurations material systems and load ranges of interest for a given application were investigated using structural procedures, structural analysis procedures, and laboratory testing of structural specimens. Both flat and curved composite compression panels that are designed either to be buckling resistant or to have postbuckling strength depending on the expected application of the panels were considered. J.M.S.

N80-28439*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DEVELOPMENT OF A LAMINATE FATIGUE ANALYSIS
George L. Roderick, T. K. OBrien (Army Aviation Research and Development Command), and John D. Whitcomb *In its* Selected NASA Res. in Composite Mater. and Struct. 1980 p 79-106 (For primary document see N80-28436 19-24)
Avail: NTIS HC A15/MF A01 CSCL 11D

A fatigue analysis technique developed to predict damage growth in notched laminates is described. Features of the analysis include: criteria to relate matrix failure to cyclic stresses in and between plies; correlation of delamination growth with strain-release rate; and in-plane shear modulus change is related to cyclic shear stresses. A simplified finite element model is used to determine stresses in laminates that contain matrix damage. Failure criteria are integrated with the finite element model to form the fatigue analysis. J.M.S.

N80-28440*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DAMAGE TOLERANCE RESEARCH ON COMPOSITE COMPRESSION PANELS
Marvin D. Rhodes *In its* Selected NASA Res. in Composite Mater. and Struct. 1980 p 107-142 refs (For primary document see N80-28436 19-24)
Avail: NTIS HC A15/MF A01 CSCL 11D

The damage tolerance of composites was investigated. Results show that severe degradation in material strength may occur due to impact damage and that reduced strain allowables should be considered to compensate for possible impact damage. The mechanisms of failure involved in impact so that local damage will be reduced and arrest of propagating fracture initiated at impact locations are examined. Compression strength reductions for damage due to impact by a 1.27 cm diameter spherical projectile in thick laminates representative of wing skin panels are presented. Also discussed are the results of concepts recently evaluated to improve damage tolerance. These concepts range from improvements at the materials level to advanced structural configurations designed to arrest or limit the growth of propagating fractures. The results indicate that substantial improvements in the damage tolerance of graphite-epoxy composite structures can be achieved through the proper combination of materials and structural design. J.M.S.

N80-28441*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HIGH TEMPERATURE RESIN MATRIX COMPOSITES FOR AEROSPACE STRUCTURES
John G. Davis, Jr. *In its* Selected NASA Res. in Composite Mater. and Struct. 1980 p 143-182 refs (For primary document see N80-28436 19-24)
Avail: NTIS HC A15/MF A01 CSCL 11D

Accomplishments and the outlook for graphite-polyimide composite structures are briefly outlined. Laminates, skin-stiffened and honeycomb sandwich panels, chopped fiber moldings, and structural components were fabricated with Celion/LARC-160 and Celion/PMR-15 composite materials. Interlaminar shear and flexure strength data obtained on as-fabricated specimens and specimens that were exposed for 125 hours at 589 K indicate that epoxy sized and polyimide sized Celion graphite fibers exhibit essentially the same behavior in a PMR-15 matrix composite. Analyses and tests of graphite-polyimide compression and shear panels indicate that utilization in moderately loaded applications offers the potential for achieving a 30 to 50 percent reduction in structural mass compared to conventional aluminum panels. Data on effects of moisture, temperature, thermal cycling, and shuttle fluids on mechanical properties indicate that both LARC-160 and PMR-15 are suitable matrix materials for a graphite-polyimide aft body flap. No technical road blocks to building a graphite-polyimide composite aft body flap are identified. J.M.S.

N80-28442*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN INVESTIGATION OF POSSIBLE ELECTRICAL HAZARDS OF CARBON FIBER COMPOSITES
Robert J. Huston *In its* Selected NASA Res. in Composite Mater. and Struct. 1980 p 183-234 refs (For primary document see N80-28436 19-24)
Avail: NTIS HC A15/MF A01 CSCL 11D

Results of an assessment of the public risk associated with the release of carbon fibers from crash-fire accidents of civil aircraft having carbon composite structures are presented. The overall national impact is shown to be extremely low in 1993. Personal injury is found to be extremely unlikely. Based on these findings, the risk of electrical failure from carbon fibers should not prevent the exploitation of composites in aircraft, and additional protection of aircraft avionics to guard aginst carbon fibers is unnecessary. J.M.S.

N80-28443*# Avco Corp., Lowell, Mass. Special Materials Div.
DEVELOPMENT OF A FIRE TEST FACILITY FOR GRAPHITE FIBER-REINFORCED COMPOSITES
J. G. Alexander Jun. 1980 48 p refs
(Contract NAS1-15511)
(NASA-CR-159193) Avail: NTIS HC A03/MF A01 CSCL 11D

A number of modifications were added to the Model 25 facility to make it specifically applicable for composite material screening tests. Most significant was the development of hardware for trapping fibers released during test and isolating them for quantitative measurement. Capability was added for increasing test section velocities and increasing the range of air/fuel ratios available from very rich to very lean. A provision was added for agitation of the test specimen and the combustion gases by a pulsating gas supply. A variety of specimen configurations was evaluated by an extensive series of tests on a graphite-epoxy reference composite which is representative of material currently used in advanced aircraft. A standard test technique and specimen configuration were established which was satisfactory for the reference composite. A test program was then performed on several alternate composite materials to

verify the validity of the test method for relative evaluation of a variety of composite materials. R.C.T.

N80-28444*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROPERTIES OF PMR POLYIMIDE COMPOSITES MADE WITH IMPROVED HIGH STRENGTH GRAPHITE FIBERS
Raymond D. Vannucci 1980 18 p refs Proposed for presentation at 12th Natl. SAMPE Tech. Conf., Seattle, 7-9 Oct. 1980
(NASA-TM-81557; E-518) Avail: NTIS HC A02/MF A01 CSCL 11D

High strength, intermediate modulus graphite fibers were obtained from various commercial suppliers, and were used to fabricate PMR-15 and PMR-2 polyimide composites. The effects of the improved high strength graphite fibers on composite properties after exposure in air at 600 F were investigated. Two of the improved fibers were found to have an adverse effect on the long term performance of PMR composites. The influence of various factors such as fiber physical properties, surface morphology and chemical composition were also examined. R.C.T.

N80-28445*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
POLAR SYMMETRY IN THREE-DIMENSIONAL ANALYSIS OF LAMINATES WITH ANGLE PLIES
I. S. Raju and John H. Crews, Jr. Jul. 1980 7 p refs
(NASA-TM-81852) Avail: NTIS HC A02/MF A01 CSCL 11D

An improved procedure for the three dimensional finite element analysis of an angle ply laminate with a circular hole is discussed. The procedure exploits polar symmetry and is the basis for a new finite element computer code. For the broad class of laminates that contain angle plies, this code requires only one half as much computing capacity as conventional codes. R.C.T.

N80-28446*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CARBON FIBER COUNTING
Richard A. Pride Jun. 1980 17 p refs
(NASA-TM-80117) Avail: NTIS HC A02/MF A01 CSCL 11D

A method was developed for characterizing the number and lengths of carbon fibers accidentally released by the burning of composite portions of civil aircraft structure in a jet fuel fire after an accident. Representative samplings of carbon fibers collected on transparent sticky film were counted from photographic enlargements with a computer aided technique which also provided fiber lengths. R.C.T.

N80-28447*# National Aeronautics and Space Administration, Washington, D. C.
METHODS FOR AN INVESTIGATION OF THE EFFECT OF MATERIAL COMPONENTS ON THE MECHANICAL CHARACTERISTICS OF GLASS-FIBER-REINFORCED PLASTICS
H.-O. Willax Apr. 1980 14 p Transl. into ENGLISH from VDI-Z (West Germany), v. 118, no. 4, 1976 p 178-182 Original language document announced as A76-22348 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original document prepared by Karlsruhe Univ., West Germany
(Contract NASw-3199)
(NASA-TM-75785) Avail: NTIS HC A02/MF A01 CSCL 11D

The materials used in the production of glass reinforced plastics are discussed. Specific emphasis is given to matrix polyester materials, the reinforcing glass materials, and aspects of specimen preparation. Various methods of investigation are described, giving attention to optical impregnation and wetting measurements and the gravimetric determination of the angle of contact. Deformation measurements and approaches utilizing a piezoelectric device are also considered. R.C.T.

N80-28448# California Univ., San Diego, La Jolla. Dept. of Applied Mechanics and Engineering Sciences.
MECHANICS OF COMPOSITE MATERIALS Final Report, Jul. 1977 - Jun. 1979
G. A. Hegemier Dec. 1979 19 p refs
(Contract F49620-76-C-0024; AF Proj. 2307)
(AD-A084547; AFOSR-80-0319TR) Avail: NTIS HC A02/MF A01 CSCL 11/4

The primary objective was to construct viable micromechanical continuum models to predict the following response measures of composite materials subject to thermomechanical process: (1) global and local stress, deformation, and diffusive (thermal and/or moisture) fields; (2) failure modes and damage accumulation; and (3) residual properties of damaged composites. Additional objectives included the development of associated variational principles from which the continuum models might be transformed to finite element form, and the performance of case studies in an effort to validate the modeling process. The model construction methodology employed is based upon the mixture theory with microstructure concept. Accordingly, all global properties are determined from the composite geometry, and the properties of the microcomponents and the microcomponents interfaces. Such as theoretical framework allows a considerable improvement in modeling capability, and provides a simulation tool that allows one to rationally guide material development and selection. In addition, and in contrast to direct micromodeling by finite difference or finite element methods, it furnishes a very efficient and inexpensive computation tool. GRA

N80-28449# University Coll. of North Wales, Bangor. School of Physical and Molecular Sciences.
PREPARATION AND PROPERTIES OF A STABLE METALLIC FERROFLUID Final Report
S. R. Hoon, S. W. Charles, and J. Popplewell Feb. 1980 101 p refs
(Grant DA-ERO-77-G-037; DA Proj. 1T1-61102-BH-57)
(AD-A084447) Avail: NTIS HC A06/MF A01 CSCL 20/3

The aim of this research work has been to characterize the properties of suspensions of small single domain iron particles in mercury. These ferromagnetic liquids have been stabilized against diffusional growth by tin, antimony, and sodium additives. That the tin, antimony, and sodium associate themselves with the iron particles to form coatings is strikingly shown in this report by resistivity and latent heat of melting experiments. GRA

N80-28450# Purdue Univ., Lafayette, Ind. Thermophysical Properties Research Lab.
SPECTRAL EMISSIVITY AT HIGH TEMPERATURES Annual Report, 1 Feb. - 31 Jan. 1980
R. E. Taylor, D. P. DeWitt, and P. E. Johnson Apr. 1980 14 p refs
(Grant AF-AFOSR-3280-77; AF Proj. 2308)
(AD-A085297; TPRL-216) Avail: NTIS HC A02/MF A01 CSCL 11/4

Progress on the development work on the Spectral Emissometer used in conjunction with the high temperature multiproperty apparatus is described. The emissometer has been demonstrated to yield state-of-the-art accuracy for the spectral emissivity in the 1.5 to 15 micrometer range above 1300 K for opaque solids. Both electrically conducting and opaque insulating samples of high technological interest have been studied. The present work was aimed primarily at increasing sensitivity to allow measurements at lower temperatures and to provide the basis for investigating semi-transparent materials. GRA

N80-28451# Lockheed-California Co., Burbank.
THE EFFECT OF ENVIRONMENT ON THE COMPRESSIVE STRENGTHS OF LAMINATED EPOXY MATRIX COMPOSITES Final Report, 15 Aug. 1977 - 28 Sep. 1979
K. N. Lauraitis and P. E. Sandorff Wright-Patterson AFB, Ohio AFML Dec. 1979 417 p refs
(Contract F33615-77-C-5140; AF Proj. 2419)
(AD-A085167; LR-28508-8; AFML-TR-79-4179) Avail: NTIS HC A18/MF A01 CSCL 11/4

The program was designed to assess the effects of temperature and absorbed moisture on the static compression behavior of epoxy matrix composites under loading conditions wherein the dominant failure modes are those which occur in structural applications. Compression test fixtures providing varying degrees of geometrical constraint were employed in order to conduct a complete series of column tests ranging from perfectly elastic to fully restrained. Two graphite/epoxy materials were evaluated, T300/5208 and AS/3501-5A. Both longitudinal and transverse

orientations of three specimen types, a 0-degree unidirectional, a quasi-isotropic and a 67%-0-degree laminate were evaluated at four temperatures, -54 C (-65 F), 22 C (72 F), 93 C (200 F) and 135 C (275 F) after exposure to one of two environmental conditions: dry, (22 C (72 F) and 40% R. H.) and wet (82 C (180 F) and 90% R.H.). Both materials were characterized under static-tension and shear loading and Tg, thermal expansion and moisture distributions were determined. Analytical procedures for predicting the column buckling behavior under various conditions were developed. Elastic buckling of the laminates investigated were relatively unaffected by moisture and temperature. The inelastic buckling curve revealed a drop due to moisture and temperature which was dependent upon material and laminate type. GRA

N80-28452# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

SHEAR MODULI OF ORTHOTROPIC COMPOSITES Final Report, 1 Jun. 1978 - 1 Oct. 1979

N. J. Pagano Mar. 1980 16 p refs

(AF Proj. 2419)

(AD-A084975; AFML-TR-79-4164) Avail: NTIS HC A02/MF A01 CSCL 11/4

The elasticity solution for a circular cylindrical body possessing rectilinear orthotropy under pure torsion is used to define an experimental approach to determine the shear moduli of orthotropic composites. Attention is focused on the transverse shear modulus of a unidirectional composite, which is not routinely measured in the characterization procedure. This property, as well as the longitudinal shear modulus, can be determined from the same specimen, which consists of transversely oriented unidirectional fiber reinforcement. The simulation of the theoretical displacement boundary conditions and failure tests are also discussed. GRA

N80-28453# General Electric Co., Philadelphia, Pa. Reentry and Environmental Systems Div.

ADL-4D6: A SILICA/SILICA COMPOSITE FOR HARDENED ANTENNA WINDOWS

J. Brazel and R. Fenton 30 Dec. 1976 10 p refs Presented at the 13th Electromagnetic Window Symp., Atlanta, 20-23 Sep. 1976

(AD-A084883; Doc-76SDR049) Avail: NTIS HC A02/MF A01 CSCL 11/4

A silica/silica composite designated 'ADL-4D6' has been developed at GE/RESD for advanced missile shock-resistant antenna window applications. It is based on RESD's 'Omniweave' 4 D reinforcement system using high purity fused silica fibers, densified to 1.6 gm/cc by repeated infiltration with an aqueous suspension of colloidal silica. This paper describes an improved fabrication process, from both the performance and cost standpoint, and summarizes mechanical, thermal and electrical design data. The results of flyer plate testing show a spall threshold of 7300-8000 taps for a 1 inch thickness, the highest spall resistance (hardening) of any known inorganic dielectric material. Minimum flexure strenghts of 5000 psi and 1.0% strain to failure have been achieved. ADL-4D6 can thus be considered a 'ductile ceramic'. GRA

N80-28454# Sandia Labs., Albuquerque, N. Mex. Systems Safety Technology Div.

THEORY FOR LAMINATED PLATES WITH A THROUGH-THE-THICKNESS CRACK

E. P. Chen 1980 20 p refs Presented at the Intern. Conf. on Fracture, Cannes, France, 29 Mar. 1980

(Contract EY-76-C-04-0789)

(SAND-80-0748C; CONF-800357-1) Avail: NTIS HC A02/MF A01

The flexural response of a laminated plate with a through the thickness crack was considered in this investigation. A laminated plate theory of the Reissner type was developed to treat this problem. For demonstration purposes, the theory was applied to a balanced symmetric laminate which contains a through the thickness central crack. The stress intensity factor for the crack is determined and the influences of the various material and geremetric parameters on the stress intensity factor are discussed. DOE

N80-28455# Oak Ridge National Lab., Tenn.

SYNTHESIS AND ELECTRONIC APPLICATIONS OF OXIDE-METAL EUTECTIC COMPOSITES

J. D. Holder, J. K. Cochran, D. N. Hill, A. T. Chapman, and G. W. Clark 1980 34 p refs Presented at Verbunderkstoffe 1980, Kontanz, West Germany, 17 Apr. 1980 Prepared in cooperation with Georgia Inst. of Technology, Atlanta

(Contract W-7405-eng-26)

(CONF-800457-1) Avail: NTIS HC A03/MF A01

Important developments in the synthesis of oxide metal eutectic composites and the composite application in the continuing development of field emitters are reviewed. Known metal oxide-metal binary and ternary eutectic systems are listed. The synthesis, electrical conductivity, thermodynamics, and applications are discussed. DOE

N80-28456# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Subdiv. Systemes.

RELATIONSHIP BETWEEN THE INTERNAL ARCHITECTURE AND PROPERTIES OF CARBON-CARBON MATERIALS WITH EXAMPLES OF APPLICATIONS [RELATION ENTRE L'ARCHITECTURE INTERNE ET LES PROPRIETES D'UN CARBONE-CARBONE ET EXEMPLE DE REALISATIONS]

J. P. Slonina (Le Carbone Lorraine, France) and J. L. Chareire Paris 28 Feb. 1979 16 p In FRENCH Presented at Conf. on Strength and Structure in Carbons and Graphites, Bath, England, 4-6 Apr. 1979

(SNIAS-792-422-114) Avail: NTIS HC A02/MF A01

A brief description is given of the liquid and gaseous methods used to fabricate such materials. Internal architecture parameters are defined: general directions of fibers, way in which fibers are grouped, and nature and density of fibers and substrates. The effect of the highly anisotropic characteristics of graphite crystals in providing strong high performance materials is discussed. Examples of applications are cited. Author (ESA)

N80-28457# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Subdiv. Systemes.

CALCULATION OF GLASS-EPOXY PRESSURE VESSELS TAKING INTO ACCOUNT GEOMETRICAL AND RHEOLOGICAL NONLINEARITIES

Gilles Bourdeau 1979 10 p refs In FRENCH; ENGLISH summary Presented at DGRST Colloq. sur les Mater. Composites, Saclay, France, Jun. 1979

(SNIAS-792-422-117) Avail: NTIS HC A02/MF A01

Calculations performed by a computer model of finite elements using isoparametric elements are described. At the beginning of calculation, the composite's mechanical characteristics are supplied by Tsai's formulation. The model takes into account two types of nonlinearities: geometrical nonlinearity and composite rheological nonlinearity. Geometrical nonlinearity is treated in the simplest manner. The structure is subject to delta P sub 1 pressure, from resulting displacements a deformed structure is obtained and is subject to a new delta P sub 2 increment. The importance of delta P sub i depends upon the nonlinear behavior of the studied structure. Rheological nonlinearity is caused by an epoxy failure. When displacements resulting from a delta P sub i are known, strains, stresses and a failure criterion are computed for every node. As soon as the failure criterion value is greater than 1 for one node in any element, an epoxy failure is assumed in the whole element. Author (ESA)

N80-28458# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Etablissement d'Aquitaine.

SOME NEW TECHNOLOGIES DEVELOPED BY SNIAS AQUITAINE [QUELQUES NOUVELLES TECHNOLOGIES DEVELOPPEES A LA SNIAS AQUITAINE]

J. C. Cantagrel and Y. Grenie Paris 1979 9 p In FRENCH Presented at Conf. on Journees du Verre Textile et des Plastiques Renforces, 28 Mar. 1979

(SNIAS-792-430-103) Avail: NTIS HC A02/MF A01

Some very high performance composite materials (carbon, glass and Kevlar filaments) developed to meet the requirements of the latest generation of ballistic motors are described. Emphasis is given to the procedures employed in their manufacture (preparation of substrates, densification with organic resins). The fabrication and utilization of reinforced phenolic foam are also discussed. Author (ESA)

N80-28459# Societe Nationale Industrielle Aerospatiale, Saint-Medard-en-Jalles (France). Etablissement d'Aquitaine.
USE OF COMPOSITE MATERIALS FOR UNDERWATER STRUCTURES [LES MATERIAUX COMPOSITES AU SERVICE DES STRUCTURES SOUS-MARINE]
Max Papot (Aerospatiale Etablissement d'Aquitaine) Paris 1979 11 p refs In FRENCH Presented at Oceanexpo Conf., Oct. 1977
(SNIAS-792-430-105) Avail: NTIS HC A02/MF A01

The excellent characteristics of coiled filament envelopes when subjected to internal pressures indicate that similar performances might be achieved for envelopes subject to external pressures. The study program conducted is presented. Comparisons are made between performances achieved with modern composites and classical materials. Some specific examples are presented including tests carried out on cylindrical shells. Suggestions are made to adapt such materials to these applications. Author (ESA)

N80-28460# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.
TRANSVERSE MICROCRACKING IN CELION 6000/PMR-15 GRAPHITE-POLYIMIDE Interim Report
J. Steven Mills, Carl T. Herakovich, and John G. Davis, Jr. (NASA Langley Research Center) Dec. 1979 131 p refs
(Grant NGR-47-004-129)
(PB80-169626; VPI-E-79-35; IR-17) Avail: NTIS
HC A07/MF A01 CSCL 11D

The effects of room temperature tensile loading and five thermal loadings, in the range -320 F (-196C) to 625F (330CC), upon the development of transverse microcracks (TVM) in Celion 6000/PMR-15 graphite-polyimide laminates were investigated. Microcracks were observed using a replicating technique, microscopy and X-ray. The mechanical or thermal load at which microcracking initiates and the ply residual stresses were predicted using laminate analysis with stress- and temperature-dependent material properties. GRA

N80-28461# National Technical Information Service, Springfield, Va.
BORON REINFORCED COMPOSITES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Apr. 1980
Diane M. Cavagnaro May 1980 262 p Supersedes NTIS/PS-79/0476; NTIS/PS-78/0357
(PB80-810138; NTIS/PS-79/0476) Avail: NTIS
HC $30.00/MF $30.00 CSCL 11D

The bibliography cites Federally funded research on boron fibers and boron compounds used as reinforcing material in composites. Included are studies on fabrication, testing, uses, and structural and mechanical properties. This updated bibliography contains 255 abstracts, 19 of which are new entries to the previous edition. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also 77 Thermodynamics and Statistical Physics.

N80-28462 Research Inst. of National Defence, Stockholm (Sweden).
ANALYTICAL LUMINESCENCE: A BIBLIOGRAPHY [LUMINESCENSANALYS. EN SAMMANSTAELLNING AV LITTERATUR]
Gunilla Eriksson, Pia Hallin, Thomas Olsson, and Anders Thore Dec. 1979 19 p refs In SWEDISH
(FOA-C-40106-B2) Avail: Issuing Activity

A literature search was performed in the areas of chemiluminescence and bioluminescence form the point of view of detection and protection techniques in biological warfare. Citations are grouped under: luciferase; bacterial luminescence; bacteriology; microbial biomass assays; immunoassay; and phagocytes. Author (ESA)

N80-28463*# United Technologies Research Center, East Hartford, Conn.
INVESTIGATION OF THE FEASIBILITY OF CARS MEASUREMENTS IN SCRAMJET COMBUSTION
John A. Shirley, Robert J. Hall, and Alan C. Eckbreth Jul. 1980 93 p refs
(Contract NAS1-15491)
(NASA-CR-159280; R79-954390-13) Avail: NTIS
HC A05/MF A01 CSCL 21B

Results are presented of analytical and experimental investigations to determine the feasibility of using coherent anti-Stokes Raman Spectroscopy (CARS) to measure temperature and species concentration in supersonic combustion experiments. The CARS spectra of H2O, O2 and H2 were measured in laboratory flames. Computer code calculated spectra agree very well with the measured spectra. Temperature, and O2 and H2 concentration profiles have been determined from CARS spectra in a laboratory H2 air flat diffusion flame. Temperature measurements agree with radiation corrected thermocouple measurements within 5 to 10 percent, depending on species concentration. The feasibility of measuring O2 concentrations up to 10 percent, from the spectral shape was demonstrated. H2 concentrations determined from CARS intensities agree with spontaneous Raman measurements within a factor of two. Finally, a conceptual design was formulated for diagnostics in the Langley Research Center scramjet combustion facility. Author

N80-28464*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
INVESTIGATION OF THE FREE FLOW ELECTROPHORETIC PROCESS Final Report
Ronald A. Weiss, J. W. Lanham, D. W. Richman, and C. D. Walker Jun. 1980 19 p
(Contract NAS8-33713)
(NASA-CR-161523; MDC-E2275) Avail: NTIS
HC A02/MF A01 CSCL 07D

The effects of gravity on the free flow electrophoretic process was demonstrated. The free flow electrophoresis chamber used to demonstrate the effects of gravity on the process was of a proprietary design. This chamber was 120 cm long, 16 cm wide, and 0.15 cm thick. Flow in this chamber was in the upward direction and exited through 197 outlets at the top of the chamber. During electrophoresis a stream of sample was injected into the flow near the bottom of the chamber and an electrical field was applied across the width of the chamber. The field caused a lateral force on particles in the sample proportional to the inherent change of the particle and the electric field strength. Particle lateral velocity was then dependent on the force due to viscous drag which was proportional to particle size and particle shape dependent. R.C.T.

N80-28465# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 6: SPHERICAL DIFFUSION FLAMES
J. D. Buckmaster and G. S. S. Ludford Mar. 1980 35 p refs
(Contract DAAG29-79-C-0121)
(AD-A084430; TR-108; ARO-15882.17-M) Avail: NTIS
HC A03/MF A01 CSCL 21/2

This report is Chapter VI of the twelve in a forthcoming research monograph on the mathematical theory of laminar combustion. Spherical diffusion flames are discussed with a view to application to the burning fuel drop. Emphasis is on establishing ignition and extinction conditions. GRA

N80-28466# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 8: THREE-DIMENSIONAL FLAMES
J. D. Buckmaster and G. S. S. Ludford Mar. 1980 31 p refs
(Contract DAAG29-79-C-0121)
(AD-A084431; TR-110; ARO-15882.18-M) Avail: NTIS
HC A03/MF A01 CSCL 21/2

This report is Chapter 8 of the twelve in forthcoming research monograph on the mathematical theory of laminar combustion.

A theory of three-dimensional flames is developed, showing the key roles played by slow variation and near equidiffusion. The basic equation of slowly varying flames is developed, while near-equidiffusional flames are shown to lead to moving-boundary problems of Stefan type. The notion of flame stretch is investigated. GRA

N80-28467# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
MATHEMATICAL THEORY OF LAMINAR COMBUSTION. CHAPTER 10: EFFECTS OF SHEAR AND STRAIN
J. D. Buckmaster and G. S. S. Ludford Mar. 1980 36 p refs
(Contract DAAG29-79-C-0121)
(AD-A084432; ARO-15882.19-M-Ch-10; TR-112-Ch-10) Avail: NTIS HC A03/MF A01 CSCL 21/2

This report is Chapter 10 of the twelve in a forthcoming research monograph on the mathematical theory of laminar combustion. The effect of flow nonuniformities on a flame is investigated by first considering simple shear and strain, and then general straining motion. Evidence for the supposed connection between flame stretch and extinction is found to be mixed. GRA

N80-28468# AeroChem Research Labs., Inc., Princeton, N. J.
IONIC MECHANISMS OF CARBON FORMATION IN FLAMES Annual Report, 1 Jan. - 31 Dec. 1979
H. F. Calcote and D. B. Olson Mar. 1980 39 p refs
(Contract F49620-77-C-0029; AF Proj. 2308)
(AD-A084675; AeroChem-TP-399; AFOSR-80-0322TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

The objective of this program is to establish a chemical mechanism of soot formation which will serve as a basis for practical solutions to the smoke problem in jet engines. An experimental program is currently underway at AeroChem to study soot formation in premixed laminar flames to test proposed chemical mechanisms, in particular the hypothesis that soot nucleates on chemically formed ions whose growth is thermochemically favored and proceeds by very rapid ion-molecule reactions. Mass spectrometric measurements of positive ion concentration profiles in rich and sooting acetylene and benzene flames show many similarities and some distinct differences. As sooting is approached by increasing the equivalence ratio, the concentration of large ions with mass greater than 300 grows rapidly. GRA

N80-28469# Pennsylvania State Univ., University Park. Dept. of Chemistry.
MOLECULAR DYNAMICS OF MIXED-METAL CLUSTERS. (C-13) AND (H-1) NMR STUDIES OF H2FeRu2(CO)13, AND H2FeRuOs2(CO)13 Interim Report
Wayne L. Gladfelter and Gregory L. Geoffroy 25 Apr. 1980 38 p refs
(Contract N00014-77-C-0417; NR Proj. 053-645)
(AD-A084356; TR-7) Avail: NTIS HC A03/MF A01 CSCL 07/4

Variable temperature H and carbon 13 NMR spectra of H2FeRu3(CO)13, H2FeRu2Os(CO)13, and H2FeRuOs(CO)13 have been measured and interpreted in view of three distinct fluxional processes. In the lowest temperature process the bridging and terminal carbonyls bound to Fe undergo localized exchange. The second process involves migration of the carbonyls around the face of the tetrahedral cluster that contains the bridging carbonyls. The highest temperature process involves a subtle reorganization of the metal framework. GRA

N80-28470*# Army Missile Command, Redstone Arsenal, Ala.
LASER-SUPPORTED COMBUSTION WAVE IGNITION IN HYDROGEN
R. W. Conrad, C. E. Pyles, E. L. Roy, and D. W. Mangum Oct. 1979 33 p refs Prepared for NASA. Marshall, Huntsville, Ala.
(NASA-CR-163320; AD-A084265; DRSMI/RH-80-1) Avail: NTIS HC A03/MF A01 CSCL 20/9

Laser-supported combustion waves were generated in hydrogen at 45 psia. Propagation velocities were inferred from radiometric measurements and compared with values for air, adjusted (according to Raizer's method) for differences in the physical properties of air and hydrogen. Coarse measurements of the radiant power in the visible region were made and compared with air plasmas produced by both pulsed and continuous wave (CW) carbon dioxide lasers. GRA

N80-28471# National Bureau of Standards, Washington, D.C. Surface Science Div.
HYDROGEN SPILL-OVER ON ALUMINA: A STUDY BY INFRARED SPECTROSCOPY
R. R. Cavanagh and J. T. Yates, Jr. May 1980 16 p refs
(Contracts N00014-80-F-0008; N00014-79-F-0008)
(AD-A084853; TR-19) Avail: NTIS HC A02/MF A01 CSCL 20/6

Infrared spectroscopy has been used to monitor the exchange of D2(g) with OH groups chemisorbed on Al2O3. It has been shown that near 300 K, the rate of the exchange process is rapid in the presence of supported Rh particles on the Al2O3. A qualitative model for hydrogen 'spillover' is presented in which dissociative adsorption of dihydrogen by the metal is a key step. It is shown that CO chemisorption on the supported Rh leads to a marked reduction in the 'spillover' rate due to site blockage on the Rh. This is consistent with recent studies of behavior of the CO and H coadsorbed on Rh(111). GRA

N80-28472# National Bureau of Standards, Washington, D.C. Surface Science Div.
TEMPERATURE EFFECTS ON THE INFRARED SPECTRUM OF CHEMISORBED CO
P. R. Antoniewicz (Tex. Univ., Austin), R. R. Cavanagh, and John T. Yates, Jr. May 1980 21 p refs
(Contracts N00014-80-F-0008; N00014-79-F-0008)
(AD-A084851; TR-17) Avail: NTIS HC A02/MF A01 CSCL 20/6

The temperature dependence of the infrared spectrum of CO chemisorbed on Rh supported by Al2O3 has been measured. A shift in the CO stretching frequency of 1.4 x 1/100 cm K-1 to higher frequency is observed on cooling. An electrodynamic model of the surface interactions is presented. The model accounts for both the magnitude and direction of the observed shift. GRA

N80-28473# Dayton Univ., Ohio.
NON-AQUEOUS ELECTRODE RESEARCH Interim Technical Report, 1 Oct. 1978 - 25 Oct. 1979
R. G. Keil, J. R. Hoenigman, W. E. Moddeman, T. N. Wittberg, and J. A. Peters Mar. 1980 76 p refs
(Contract F33615-77-C-3156)
(AD-A085154; UDR-TR-79-104; AFWAL-TR-80-2018) Avail: NTIS HC A05/MF A01 CSCL 07/4

This report describes work carried out in the second 13 months of a 33 month contract to characterize the passive films formed on anodes commonly used in non-aqueous battery cells, and to identify cell reaction products formed at the carbon cathode commonly used in these cells. GRA

N80-28474# California Univ., Irvine. Dept. of Chemistry.
ULTRAVIOLET ABSORPTION CROSS SECTIONS OF HO2 NO2 VAPOR Final Report, Sep. 1978 - Dec. 1979
Luisa T. Molina and Mario J. Molina Apr. 1980 32 p refs
(Contract DOT-FA78WA-4248)
(AD-A084915; FAA-EE-80-07) Avail: NTIS HC A03/MF A01 CSCL 07/5

The ultraviolet absorption cross sections for gas phase HO2 NO2 have been measured between 190 and 330 nm, at 298 K and 1 atm total pressure. The HO2 NO2 vapor was prepared in a flowing N2 stream in the presence of H2O, H2O2, HNO3, and NO2. The composition of the mixture was established by visible and infrared absorption spectroscopy and by chemical titration after absorption in aqueous solutions. The experimental uncertainty (one standard deviation) ranges from 5% at 200 nm to 30% at 330 nm, and mainly falls in the 10% range. The solar photodissociation rate in the troposphere and lower stratosphere is estimated to be about ten to the -5th power/sec for 0 deg solar zenith angle. GRA

N80-28475# Woods Hole Oceanographic Institution, Mass. Dept. of Chemistry.
GAS CHROMATOGRAPHY-MASS SPECTROMETRY FACILITY: RECENT IMPROVEMENTS AND APPLICATIONS

Nelson M. Frew and Richard M. Sondo Mar. 1980 93 p refs
(Contracts N00014-68-C-0241; N00014-74-C-0262; EE-77-S-02-4256; Grants NSF OCE-74-22781; NSF OCE-76-08696; NSF OCE-74-09991; NSF OCE-77-26084; NSF GC-44224; EPA-R-80390; EPA-R-804215)
(AD-A084826; WHOI-79-26) Avail: NTIS HC A05/MF A01 CSCL 07/4

Marine organic and organic geochemical studies require the best available performance in trace analysis of organic compounds in environmental samples. This report briefly outlines some of the recent improvements in the experimental capabilities of the Chemistry Department Gas Chromatography/Mass Spectrometry Facility (GC/MS Facility) from a user-oriented and non-technical viewpoint. These improvements include principally the interfacing of high performance glass capillary columns with Finnigan 1015 and 3200 quadrupole mass spectrometers, and the adaptation of the latter for use with selective chemical ionization (CI) techniques. Some of the new capabilities available using combined glass capillary GC/EI-MS and CI-MS are illustrated with examples from research in several areas of marine organic chemistry. These include studies of volatile organics in seawater, the distributions of various lipid class compounds in marine phytoplankton, sediments and particulate matter, and the behavior of anthropogenic pollutants in natural and artificial marine ecosystems. GRA

N80-28476# Indiana Univ. at Bloomington. Dept. of Chemistry.
CORRECTION OF QUENCH ERRORS IN ANALYTICAL FLUORIMETRY THROUGH USE OF TIME RESOLUTION
Gary M. Hieftje and Gilbert R. Haugen 27 May 1980 21 p refs Submitted for publication
(Contract N00014-76-C-0838; Grant GM-24473)
(AD-A085130; TR-25) Avail: NTIS HC A02/MF A01 CSCL 07/5

Varying concentrations of quenching agents can cause serious errors in analytical fluorimetry. The origin of these errors is an unexpected change in the quantum efficiency for the observed luminescence. In this paper, it is recalled that quantum efficiency can be expressed as the ratio of an observed luminescence decay time to the decay time which would be observed in the absence of quenchers. Because this latter quantity is a constant for any particular fluorophore, quantum efficiency variations can be compensated through measurement of the decay time. For such measurements, the time-correlated single photon technique was employed and measured luminescence values were taken both from averaged photon count rates and from integrated fluorescence decay plots. Division of these values by measured luminescence lifetimes produced values which were independent of quencher concentration. Systems studied were quinine bisulfate quenched with chloride ion and 1-pyrenebutyric acid quenched by iodide. GRA

N80-28477# Ad-Ex International, Portola Valley, Calif.
EFFICIENT MATRIX CORRECTION IN X-RAY FLUORESCENCE SPECTROMETRY
Rolf Plesh and B. Thiele 11 Dec. 1979 18 p refs Transl. into ENGLISH of Anal. Chim. Acta. (West Germany), vol. 112, 1979 p 75-82
(PNL-TR-375) Avail: NTIS HC A02/MF A01

The SPECTRA 310 program for matrix correction in X-ray fluorescence spectrometry allows concentrations as well as intensities of the matrix elements to be included in the correction factors. Alongside an existing testing system, this allows the efficiency of the correction method to be estimated and the quality of standards to be assessed. A program for trace analysis improves general analysis in the trace range, and a test program allows conclusions to be made about the statistical precision of the analytical equipment used. DOE

N80-28478# Missouri Univ. -Rolla. Materials Research Center.
CHEMICAL AND PHYSICAL STABILITY OF REFRACTORIES FOR USE IN COAL GASIFICATION Quarterly Progress Report, 1 Nov. 1979 - 31 Jan. 1980
Abbas Fakhr and Dalbert E. Day 31 Jan. 1980 29 p
(Contract EY-76-S-02-2904)
(COO-2904-15; QPR-15) Avail: NTIS HC A03/MF A01

The dependence of the chemical reactions occurring in the cement bond portion of the castables upon the degree of saturation was determined for pure steam and the DOE atmosphere. Boehmite, C4A3H3 and calcite are the major components formed. Only the amount of boehmite varied significantly with the degree of saturation. A linear relationship exists between the percent saturation and the amount of boehmite up to 70% saturation. Above 70%, the amount of boehmite is nearly constant and independent of the degree of saturation. The minimum percent saturation required to form boehmite varied from 10% to 30% according to the atmosphere and pressure. Mechanical properties (namely flexural strength) also varied with the percent saturation. Those parts of the specimens exposed to greater than 50% saturated atmosphere were appreciably stronger (2 to 3 times). The relative severity of the corrosion of several refractory castables by either liquid or saturated vapor was determined for pure steam, the DOE atmosphere, and CO-steam atmospheres. The thermal expansion data obtained for the castables after exposure to above mentioned atmospheres and conditions are summarized. DOE

N80-28479# Pennsylvania State Univ., University Park. Dept. of Chemistry.
DEVELOPMENT OF INSTRUMENTAL METHODS OF ANALYSIS OF SULFUR COMPOUNDS IN COAL PROCESS STREAMS Quarterly Technical Progress Report, Oct. - Dec. 1979
Joseph Jordan Jan. 1980 25 p refs
(Contract EF-77-S-01-2710)
(FE-2710-9; QR-9) Avail: NTIS HC A02/MF A01

Capabilities for constructing multidimensional Pourbaix Diagrams were expanded. Algorithms were developed for the generation of abundance profiles and for delineating thermodynamic stability domains of polysulfur moieties, which contain several atoms of sulfur per molecule. Mechanisms of electrooxidation of thiosulfate and of dibenzothiophene were investigated. Under judiciously controlled experimental conditions, these electrode reactions proceed with 100% current efficiency at glassy carbon anodes. They provide a sound theoretical basis for dependable electroanalytical methods applicable to the determination of S2O3(-) and of dibenzothiophene in coal conversion process streams and products. The systematic search for specific reagents, amenable to the determination of sulfur contaminants by thermometric enthalpy titration and by direct injection enthalpimetry, was continued. DOE

N80-28480# Argonne National Lab., Ill. Chemical Engineering Div.
DIATOMACEOUS EARTH AND ACTIVATED BAUXITE USED AS GRANULAR SORBENTS FOR THE REMOVAL OF SODIUM CHLORIDE VAPOR FROM HOT FLUE GAS
Sheldon H. D. Lee and William M. Swift Jan. 1980 39 p refs
(Contract W-31-109-eng-38)
(ANL/CEN/FE-79-18) Avail: NTIS HC A03/MF A01

Diatomaceous earth and activated bauxite were tested as granular sorbents for use as filter media in granular bed filters for the removal of gaseous alkali metal compounds from the hot (800 C) flue gas of pressurized fluidized bed combustion (FBC). Tests were performed at atmospheric pressure, using NaCl vapor transported in relatively dry simulated flue gas of PFBC. Either a fixed bed combustor or a high temperature sorption test rig was used. The effects of sorbent bed temperature, superficial gas velocity, gas hourly space velocity, and NaCl vapor concentration in flue gas on the sorption behavior of these two sorbents and their ultimate sorption capacities were determined. Both diatomaceous earth and activated bauxite were found to be very effective in removing NaCl vapor from flue gas. Preliminary cost evaluations showed that they are economically attractive as granular sorbents for cleaning alkali vapor from simulated flue gas. DOE

N80-28481# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
COMBUSTION RESEARCH, FISCAL YEAR 1979
Mar. 1980 62 p refs Submitted for publication
(Contract W-7405-eng-48)
(LBL-10416) Avail: NTIS HC A04/MF A01

The chemical and physical processes which are important

in utilizing new fuels while limiting pollutant formation are examined along with reduction of fire hazards associated with energy generation and conservation technologies. Principal program areas include the interaction of fluid mechanical turbulence and combustion, pollutant formation and destruction processes, physical and chemical diagnostic techniques for combustion research, theoretical and computational modeling of combustion processes, combustion processes in engines, flame propagation, and fire safety. Thirty combustion research programs are identified and described briefly. DOE

N80-28482# Delaware Univ., Newark. Dept. of Chemical Engineering.
DEVELOPMENT OF UNIQUE CATALYSTS FOR HYDRODE-NITROGENATION OF COAL-DERIVED LIQUIDS Quarterly Report, 15 Sep. - 15 Dec. 1978
James R. Katzer, Alvin B. Stiles, and Harold Kwart 1 Mar. 1979 122 p refs
(Contract EI-78-S-01-3297)
(FE-3297-1; QR-1) Avail: NTIS HC A06/MF A01

Four experimental runs were made; two used decahydroquinoline as reactant and two runs were made using orthoethylaniline and quinoline-N-oxide respectively. The decahydroquinoline runs indicate that the carbon-nitrogen bond scission is not thermal but clearly catalytic. Important findings resulted from the run using oethylaniline and future runs will help define reaction pathways. Quinoline-N-oxide was rapidly deoxygenated to form quinoline under the conditions tested. Future runs will be conducted in the absence of hydrogen to avoid deoxidation of quinoline-N-oxide and to find out whether carbon-nitrogen bond scission can be promoted by the addition of oxygen to the quinoline molecule. A review paper has been prepared that reviews the existing chemistry and technology for hydrodenitrogenation of synthetic feedstocks and heavy petroleum liquids. It projects what should be a more effective means and more rational basis for the design and development of more active and more selective catalysts for hydrodenitrogenation and attempts some speculations on potentially fruitful direction to be followed in both catalyst and process development. DOE

N80-28483# Oak Ridge National Lab., Tenn.
TRITIUM PERMEABILITY OF STRUCTURAL MATERIALS AND SURFACE EFFECTS ON PERMEATION RATES
J. T. Bell, J. D. Redman, and H. F. Bittner 1980 19 p refs Presented at Tritium Tech. in Fission, Fusion and Isotopic Appl., Dayton, Ohio, 29 Apr. 1980
(Contract W-7405-eng-26)
(CONF-800427) Avail: NTIS HC A02/MF A01

An attempt was made to minimize tritium release from a given system by two primary efforts. First, a compatible containment material which frequently also will be the structural material was selected. This effort included films and barriers that were compatible with the structural material. Second and sometimes more important, the surface chemistry of material was such that it continuously impeded tritium permeation. DOE

N80-28484# Sandia Labs., Albuquerque, N. Mex. Tube Development Div.
METAL TRITIDES HELIUM EMISSION
Leonard C. Beavis Feb. 1980 36 p refs
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-0645) Avail: NTIS HC A03/MF A01

The data obtained from samples in the early (low helium concentration) release stage are presented. The samples discussed include those at room temperature of titanium, zirconium, scandium, and erbium tritides. Results of the stoichiometry effect measurements on erbium tritide films are included. In addition, details of the effects of the grain size, storage temperature, and thermal ramp on helium emissions from erbium tritide films are given. Measurements of the helium release from single crystal scandium-0.4 tritium are described. DOE

N80-28485# Massachusetts Inst. of Tech., Oak Ridge, Tenn. School of Chemical Engineering.
SEPARATION OF WATER-ETHANOL MIXTURE BY SORPTION
W. A. Schumacher and V. W-S. Hwa Jan. 1980 16 p refs
(Contract W-7405-eng-26)
(ORNL/MIT-298) Avail: NTIS HC A02/MF A01

An experimental investigation was performed which examined sorption as a means for recovering anhydrous ethanol from water-ethanol mixtures. Adsorption isotherms were obtained at ambient temperature for two sorbents: a styrene-divinylbenzene copolymer manufactured by Rohm & Haas (Amberlite XAD-4) and Linde molecular sieve (No. 4966-77). Both sorbents appeared to reach a saturation level of ethanol on the sorbent for the range of ethanol concentration considered (0 to 12 wt % ethanol). The Linde sieve was more effective than the Rohm & Haas copolymer for the removal of ethanol from dilute solutions. DOE

N80-28486# Oak Ridge National Lab., Tenn.
THERMOCHEMICAL WATER-SPLITTING CYCLES BASED UPON REACTIONS OF CERIUM- AND ALKALINE EARTH PHOSPHATES
P. R. Robinson and C. E. Bamberger 1979 5 p refs Presented at 2nd Miami Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10 Dec. 1979
(Contract W-7405-eng-26)
(CONF-791204-35) Avail: NTIS HC A02/MF A01

Cerium(4) oxide, CeO2, reacts with derivatives of phosphoric acid, metaphosphate salts, and pyrophosphate salts at 600 to 1000 C to produce oxygen and cerium(3) phosphates. The cerium(3) phosphates are oxidized to CeO2 by steam at 700 to 1200 C in the presence of alkaline earth oxides, carbonates, or halides. These two sets of reactions form the basis for a family of thermochemical cycles based upon the redox couple Ce(4)/(3). DOE

N80-28487# Universite Scientifique et Medicale de Grenoble (France). Lab. de Spectrometric Physique.
[ACTIVITIES OF THE PHYSICAL SPECTROMETRY LABORATORY] Activity Report, Jan. 1977 - Apr. 1979 [LABORATOIRE DE SPECTROMETRIE PHYSIQUE. RAPPORT D'ACTIVITE JANVIER 1977 A AVRIL 1979]
1979 116 p refs In FRENCH
Avail: NTIS HC A06/MF A01

The work conducted during the reporting period is outlined in the following areas: atomic and molecular physics, spectroscopy of molecular solids, nuclear magnetic resonance in condensed matter, theoretical activities, the Mossbauer effect, phase transitions in solids, semiconductors and electrochemistry, polymer studies, optics of solids, surface studies, and crystalline structures. Author (ESA)

N80-28488# Los Alamos Scientific Lab., N. Mex.
TRACE ELEMENT CHARACTERIZATION OF COAL WASTES Annual Progress Report, 1 Oct. 1977 - 30 Sep. 1978
E. M. Wewerka, J. M. Williams, L. E. Wangen, J. P. Bertino, and P. L. Wanek Jun. 1979 94 p refs Sponsored by EPA and DOE
(PB80-166150; LA-7831-PR; EPA-600/7-79-144; AR-3) Avail: NTIS HC A05/MF A01 CSCL 07D

The efficacy of several control options to treat coal wastes at the preparation plant or during disposal was investigated. The research revealed that calcining is one of the more effective and permanent means of treating high sulfur coal wastes before disposal to decrease, quite dramatically, the release of environmentally undesirable pollutants into the drainages from disposal sites. Co-disposal of the coal wastes with lime or limestone to neutralize the acid drainage and contain soluble aqueous contaminants within the waste site is also a promising control. Other experiments examined the feasibility of using natural sealants (e.g., clays, soils, calcite, and cements) to isolate the disposal site from its immediate environment. Various trade offs for these control options are discussed in terms of contaminant reduction, complexity, permanency, and cost. GRA

N80-28489# National Bureau of Standards, Washington, D.C. National Measurement Lab.
THE DEVELOPMENT OF AN AQUEOUS TRACE ORGANIC STANDARD REFERENCE MATERIAL FOR ENERGY RELATED APPLICATIONS: INVESTIGATION OF THE AQUEOUS SOLUBILITY BEHAVIOR OF POLYCYCLIC AROMATIC HYDROCARBONS Interim Report, Nov. 1978 - May 1978
Willie E. May Feb. 1980 90 p refs

(PB80-189352; EPA-600/7-80-031) Avail: NTIS
HC A05/MF A01 CSCL 07D

The development of a generator column technique for the production of standard reference materials for polynuclear aromatic hydrocarbons (PAH's) in water is discussed. The extent of the rate of the dissolution of energy based PAH's and their persistance in the aquatic environment is assessed. GRA

N80-28490# Little (Arthur D.), Inc., Cambridge, Mass.
PREPARATION OF STANDARDS FOR VALENCE STATE MEASUREMENT BY X-RAY FLUORESCENCE Final Report
Edward T. Peters and Kenneth T. Menzies Jan. 1980 43 p
(Contract EPA-68-02-2750)
(PB80-169238; EPA-600/2-80-025) Avail: NTIS
HC A03/MF A01 CSCL 07D

A total of 40 single state and 13 multistate standards were prepared by dust generation and collection on polycarbonate filters. The prepared samples and valence states include sulfur (0, +4, +6, -2), vanadium (0, +4, +5), and chromium (+3, +6). At least three standards were prepared for each valence state, with mass concentration of the valence state element in the range 1 to 50 micrograms/sq cm. The prepared samples were coated with a thin layer of nitrocellulose by a wicking procedure to provide a protective coating and to prevent loss of material. Representative samples were analyzed for the uniformity of the deposit, mean particle size and stability in air, and X-ray irradiation. GRA

N80-28491# Georgia Univ., Athens. Dept. of Chemistry.
NEW LIQUID CHROMATOGRAPHIC DETECTION SYSTEM FOR ENVIRONMENTAL POLLUTANTS Final Report, Jan. 1978 - Dec. 1978
L. A. Carreira and L. B. Rogers Feb. 1980 74 p refs
(Grant EPA-R-804155-03-0)
(PB80-166911; EPA-600/4-80-015) Avail: NTIS
HC A04/MF A01 CSCL 07D

Resonance enhanced coherent anti-Stokes Raman spectrometry (CARS) was demonstrated as a specific identification system for liquid chromatography for water pollution identification. Liquid chromatographic preconcentration and separation and computer control of the liquid chromatograph/ultraviolet visible/CARS were undertaken. Observations useful in relating experimental variables in the preconcentration step to the recovery of a given species were made. A system consisting of a liquid chromatograph, a scanning ultraviolet visible spectrometer and the CARS was automated using a minicomputer. Column selection, flow rate, and solvent composition were monitored and controlled. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-28452* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
HEAT TREAT FIXTURE AND METHOD OF HEAT TREATING Patent
Charles S. Beuyukian (Rockwell International Corp., Downey, Calif.), Robert M. Heisman (Rockwell International Corp., Downey, Calif.), Cyrus C. Haynie (Rockwell International Corp., Downey, Calif.), and Emil P. Ruppe, inventors (to NASA) (Rockwell International Corp., Downey, Calif.) Issued 15 Jul. 1980 4 p
Filed 23 Mar. 1979 Supersedes N79-25197 (17 - 16, p 2104)
Sponsored by NASA
(NASA-Case-LAR-11821-1; US-Patent-4,212,690;
US-Patent-Appl-SN-023501; US-Patent-Class-148-131;
US-Patent-Class-266-119; US-Patent-Class-266-249;
US-Patent-Class-266-274) Avail: US Patent and Trademark Office CSCL 11F

A heat treating fixture is disclosed in which the shape of the metal specimen is maintained by cold rolled steel support plates. Glide sheets of stainless steel, coated with boron nitride, in contact with each face of the metal specimens, allow for lateral expansion of the metal specimens without binding. Grooved support bars separate the glide sheets from the upper and lower support plates and allow flow of quenching fluid to the metal specimen.
Official Gazette of the U.S. Patent and Trademark Office

N80-28493 California Univ., Berkeley.
DIRECT DECOMPOSITION OF AUSTENITE IN Fe-C-V ALLOYS THROUGH ISOTHERMAL TRANSFORMATION Ph.D. Thesis
Yoshimao Mishima 1979 95 p
Avail: Univ. Microfilms Order No. 8014813

Isothermal austenite decomposition was investigated in Fe-0.2C-1V-0.5Mn and Fe-0.1C-0.5V-0.5Mn alloys. Both alloys exhibited C-curve austenite decomposition kinetics which were analogues to the pearlite transformation at temperatures above the bainite transformation region. In the C-curve regime, austenite decomposed into ferrite and vanadium carbide (VC) with two different carbide morphologies. It was determined by transmission electron microscopy that the morphology of VC was either as discrete particles, fibers or both. The VC morphology was found to be dependent on the composition of the alloy, isothermal transformation temperature, and austenization temperature. The associated mechanical properties were measured with emphasis being placed on Charpy impact behavior. It was found that the impact toughness of the austinite decomposition product was strongly dependent on VC morphology despite the fact that the tensile properties were relatively insensitive to it. The factors which control the VC morphology are discussed. Dissert. Abstr.

N80-28494 California Univ., Berkeley.
MICROSTRUCTURE, MECHANICAL PROPERTIES AND TWO-BODY ABRASIVE WEAR RESISTANCE IN STEELS Ph.D. Thesis
Nareshchandra Jitendrakmur Kar 1979 180 p
Avail: Univ. Microfilms Order No. 8014754

A base secondary hardening steel (Fe0.4C2Mo0.25V) and its alloy modifications (2%Cr, 2%Cr + 3%Ni) were investigated using conventional quenching and tempering treatments and isothermal transformation in the vicinity of M sub s temperatures followed by tempering to the secondary hardening range. The mechanical properties, microstructure (using transmission electron microscopy) and two body abrasive wear resistance of the different heat treated variants were evaluated. Secondary hardening in the quenched and tempered microstructure was related to the rate of replacement of primary Fe3C by Mo2C carbides. Low toughness at the seconary hardening peak because of the presence of interlath cementite was eliminated by alloy modification, to give high hardness high toughness on secondary hardening. Dissert. Abstr.

N80-28495 Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique des Materiaux.
HOT STRESS CORROSION OF TITANIUM ALLOYS BY CHLORIDES Final Report [ETUDE DE LA CORROSION SOUS TENSION A CHAUD DES ALLIAGES DE TITANE PAR LES CHLORURES]
Gilles Lapasset Jan. 1978 37 p refs In FRENCH
(Contract DGRST-75-7-0990)
Avail: Issuing Activity

The mechanisms occurring in TA 6V with salt deposits at between 350 and 400 C were studied, together with the effects of water, hydrogen and oxygen. The electrochemical processes taking place were elucidated as well as the phenomena associated with the initiation and progression of cracks. The advantages of heat cycling are mentioned. Author (ESA)

N80-28496 Foerenade Fabriksverken, Linkoeping (Sweden). Materials Lab.
EFFECT OF SOLID LUBRICANT PWA 474 ON THE FATIGUE STRENGTH OF TITANIUM ALLOY Ti-6Al-4V
Gunnar Burman 20 Apr. 1978 18 p
(Contract FMV-FMO-82302-76-000-00-005)
(FFV-R-9581-0189-2) Avail: Issuing Activity

The protective effect of the solid lubricant PWA 474 on wear and fatigue properties of titanium alloy Ti-6Al-4V was studied. Wear was effected by shoulders clamped to the specimen during the fatigue testing. Results indicate that Woehler diagrams for the two specimen series can be plotted. The solid lubricant at high fatigue levels (fracture before 600,000 cycles) extended

the testing time to rupture 3 to 4 times. The fatigue limit for solid lubricant coated specimens lies 50% above the fatigue limit of unlubricated specimens. Determination was made of the friction coefficient of solid lubricant surfaces and pure titanium surfaces. The friction coefficient is 0.12 to 0.15 for solid lubricant (solid lubricant and 0.35 to 0.40 for titanium) titanium. Author (ESA)

N80-28497# Royal Aircraft Establishment, Farnborough (England).
THE DIFFUSION OF WATER VAPOUR IN HUMID AIR INTO THE ADHESIVE LAYER OF BONDED METAL JOINTS
Walter Althof Feb. 1980 71 p refs Transl. into ENGLISH of "Die Diffusion des Wasserdampfes der Feuchten Luft in die Klebschichten von Metallklebungen" DFVLR-FB-79-06 Deutsche forschungs und Versuchsanstalt Fuer Luft und Raumfahrt, West Germany, 1979
(RAE-Lib-Trans-2038; BR74940) Avail: NTIS HC A04/MF A01

The variation of moisture content with time and environment was determined for five aircraft structural adhesives by weighing cured bulk adhesive specimens and laminates before and after extended exposure in six climates. The coefficient of diffusion was calculated according to Fick's theory. The correlation between the moisture content in the adhesive at saturation and the atmospheric humidity was estimated. Several formula were established to calculate the time dependent distribution of moisture in adhesive laminates. Control tests confirmed the applicability of the formula, where the adhesive was not altered by the environment. R.C.T.

N80-28498*# National Aeronautics and Space Administration, Washington, D. C.
PHASE TRANSITIONS IN THE ORDERED COMPOUND TiAl AND IN ALLOYS HAVING IT AS A BASE
I. A. Zelenkov and E. N. Martynchuk May 1980 11 p refs Transl. into ENGLISH from Metallofiz. (USSR), no. 50, 1974 p 99-103 Original language doc. announced as A74-40461 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by Kiev Inst. of Civil Aviation Engineers
(Contract NASw-3199)
(NASA-TM-75827) Avail: NTIS HC A02/MF A01 CSCL 11F

The combined effect of alloying and heat treatment on the order-disorder transition in TiAl of stoichiometric composition was investigated. It is concluded from the data obtained that the TiAl 1 to TiAl 2 transition is a phase transition of the second kind. A phase transition was observed in TiAl of equiatomic composition in the 450-550 C temperature range. The introduction of niobium into the ordered compound TiAl of stoichiometric composition, instead of titanium or aluminum atoms, leads to partial softening. In this case, the effect of niobium atoms on softening of the alloys was greater when the niobium was introduced in place of aluminum atoms. R.C.T.

N80-28499*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.
MATERIALS FOR ADVANCED TURBINE ENGINES. VOLUME 1: POWER METALLURGY RENE 95 ROTATING TURBINE ENGINE PARTS Final Report
W. R. Plouts, C. E. Shamblen, J. S. Mosier, R. E. Peebles, and R. W. Gorsler Jun. 1979 358 p 2 Vol.
(Contract NAS3-20074)
(NASA-CR-159802; R79AEG416-Vol-1) Avail: NTIS HC A16/MF A01 CSCL 11F

An attempt was made to improve methods for producing powder metallurgy aircraft gas turbine engine parts from the nickel base superalloy known as Rene 95. The parts produced were the high pressure turbine aft shaft for the CF6-50 engine and the stages 5 through 9 compressor disk forgings for the CFM56/F101 engines. A 50% cost reduction was achieved as compared to conventional cast and wrought processing practices. An integrated effort involving several powder producers and a major forging source were included. R.C.T.

N80-28500# Naval Postgraduate School, Monterey, Calif.
THE EFFECT OF MULTIPLE WELD REPAIRS ON THE FATIGUE RESISTANCE OF WELDED ALUMINUM ALLOY 5083-0 M.S. Thesis
John R. Panico Dec. 1979 59 p refs
(AD-A084379) Avail: NTIS HC A04/MF A01 CSCL 11/6

This work follows that of Lt. G. R. Speight, USCG, on the general microstructural and mechanical property effects of multiple weld repairs in 5083-0 aluminum, and extends the previous study in to the area of fatigue. The essential observation made is that multiple weld repairs do not significantly affect the fatigue resistance of the material. Microstructural changes in the base metal do not alter crack initiation and propagation characteristics, failure being confined to the weld filler material. GRA

N80-28501# Cincinnati Univ., Ohio. Dept. of Materials Science and Metallurgical Engineering.
MICROSTRUCTURAL EFFECTS AND FATIGUE LIFE PREDICTION OF NOTCHED AND UN-NOTCHED Ni BASE SUPERALLOYS AT ELEVATED TEMPERATURES Final Report, 1 Jan. 1976 - 31 Dec. 1979
Stephen D. Antolovich Apr. 1980 54 p refs
(Grant AF-AFOSR-2952-76)
(AD-A084436; AFOSR-80-0341TR) Avail: NTIS HC A04/MF A01 CSCL 11/6

The LCF(Low Cycle Fatigue) behavior of Ni base superalloys was studied both for smooth and notched test bars. The primary research material was Rene 80 which finds application in turbine blades used in the temperature range of 650-982 C (1200-1800 F). The smooth bar LCF behavior was studied in the as-heat treated condition and also after exposure for 100h at 982 C, either under a stress of 97 MPa (14 ksi) or OMPa. Test conditions included continuous cycling at different strain rates as well as 90 second hold periods at either maximum or minimum strain. The primary test temperatures were 871 C (1600 F) and 982 C (1800 F). It was found that prior exposure greatly reduces the fatigue life. Since these experiments tend to duplicate actual engine conditions, use of data obtained using as heat treated specimens may be very non conservative to predict lives of actual components. The test results correlated very well with a model for LCF which is based on the concept that cracks initiate at a critical combination of oxide depth and stress. The notch LCF problem was also studied. A computer model for calculating local stresses and strains was developed. In addition to the Rene 80 studies, some initial smooth bar LCF studies were carried out using Rene 77. GRA

N80-28502# Army Materials and Mechanics Research Center, Watertown, Mass. Materials Research Div.
BALLISTIC DAMAGE CHARACTERISTICS AND FRACTURE TOUGHNESS OF LAMINATED ALUMINUM 7049-T73 AND TITANIUM 6AI-4V ALLOYS Final Report
Charles F. Hickey, Jr. and Albert A. Anctil Mar. 1980 19 p refs Sponsored in part by Naval Air Systems Command
(DA Proj. 1L1-62105-AH-84)
(AD-A084698; AMMRC-MS-80-1) Avail: NTIS HC A02/MF A01 CSCL 11/6

The degradation of metal laminate structural properties resulting from damage by 12.7 mm API projectiles fired at 1600 feet per second were defined. Two materials (Al-7049 and Ti-6Al-4V laminates) were measured ranging from 0.100 to 0.400 inch in normal thickness. Results indicate that laminate thickness over the range studied has little or no effect on the fracture toughness of either Al-7049 or Ti-6Al-4V. The ballistic penetration mechanism for both alloys was by petalling and in general the damage increased as a function of laminate thickness. R.C.T.

N80-28503# Rockwell International Corp., Thousand Oaks, Calif.
FINE GRAIN ALUMINUM SUPERPLASTICITY Final Report, 29 Sep. 1978 - 31 Mar. 1979
C. H. Hamilton Feb. 1980 66 p refs
(Contract DAAK10-78-C-0424; DA Proj. 1L1-62105-AH-84)
(AD-A084692; AD-E400400; SC5187.13FR; ARSCD-CR-80001) Avail: NTIS HC A04/MF A01 CSCL 20/1

Fine grained 7475 aluminum alloy sheet was evaluated for its superplastic properties and potential for superplastic forming. The sheet alloy was specially processed by the ALCOA Technical Laboratory utilizing procedures prescribed by the contractor to achieve a fine grain size. The grain size measurements on this sheet alloy after complete recrystallization revealed a short

transverse dimension of 7.8 microm and longitudinal and long transverse dimension of 14 microm. Subsequent grain growth studies showed that this fine grain size developed is quite stable at temperatures as high as 516 C. High temperature testing was conducted over the temperature range of 427 C to 516 C in order to establish the strain rate sensitivity of flow stress, strain hardening characteristics, and total elongation capabilities. Superplastic forming tests were also conducted utilizing commonly used gas pressure forming methods. Small demonstration parts were formed over a range of strain rates and thinning characteristics evaluated. Metallographic evaluation of tensile test specimens and formed parts revealed the tendency of the alloy to form internal voids, or cavities, at large strains. The cavitation appears to be sensitive to the conditions of deformation, being minimized at the higher temperature and lower strain rate. GRA

N80-28504# Universal Energy Systems, Inc., Dayton, Ohio.
SURFACE CHARACTERIZATION OF CHEMICALLY TREATED TITANIUM AND TITANIUM ALLOYS Interim Report, 1 May - 30 Nov. 1979
Alain A. Roche Wright-Patterson AFB, Ohio AFWAL Feb. 1980 180 p refs
(Contract F33615-79-C-5129)
(AD-A084171; AFWAL-TR-80-4004) Avail: NTIS HC A09/MF A01 CSCL 11/6

A thorough knowledge of adherend surfaces is necessary to adequately evaluate adhesive bond joint performance. Auger Electron Spectroscopy (AES), Secondary Ion Mass Spectroscopy (SIMS), Scanning Electron Microscopy (SEM), and X-Ray Photoelectron Spectroscopy (XPS) were used to characterize the surface topography (roughness, selective etching) composition (relative concentration of alloyed element on surface, contaminated overlayer...) chemical state (titanium or alloy surface oxide, oxy-fluoride...) and oxide thickness of different chemically treated titanium alloys. Seven alloys and the metal were conditioned with seven different chemical treatments. Data from each treated alloy has been compiled to show physical and chemical effects of each treatment on each alloy. GRA

N80-28505# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL STUDY OF DROPWISE CONDENSATION ON VERTICAL DISCS M.S. Thesis
Kevin Patrick Perkins Dec. 1979 92 p refs
(AD-A085052) Avail: NTIS HC A05/MF A01 CSCL 11/3

Three hydrophobic coating systems were tested for their ability to promote permanent dropwise condensation of steam at 21 KPa (3 psia). The coatings used were: (1) Nedox, a Teflon coating that uses a porous nickel substrate to improve adhesion, (2) Sputtered Teflon, and (3) C-6 fluoroepoxy, a protective coating developed for naval aircraft. Copper-nickel discs, 32 mm in diameter, were tested with all three coatings. In addition, copper and titanium discs were tested with the sputtered Teflon coating. Coating thickness was varied from 0.08 to 25.0 microns. The coatings tested provided only moderate improvements in heat transfer. The 0.08 micron coating of sputtered Teflon on copper-nickel provided only a 58% improvement in the heat transfer coefficient over filmwise. A chemically promoted specimen tested in the same experimental apparatus gave a 500% improvement in the heat transfer coefficient. All coatings tested showed surface deterioration after two to ten hours of testing, and none would be considered a practical permanent promoter of dropwise condensation. GRA

N80-28506# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION INTO THE INFLUENCE OF THERMO-MECHANICAL PROCESSING ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF HIGH-STRENGTH ALUMINUM-MAGNESIUM ALLOYS M.S. Thesis
William Goodwin Speed Dec. 1979 42 p refs
(AD-A085051) Avail: NTIS HC A03/MF A01 CSCL 11/6

Microstructures and mechanical properties resulting from thermomechanical processing of high magnesium (Mg) content aluminum-magnesium (Al-Mg) alloys were investigated in this research. Warm rolling processes, intended to refine both grain size and second phase Al3Mg2 (beta) particle size, were conducted for alloy compositions of 10.2 weight % Mg, 10.2 weight % Mg plus 0.5 weight % copper (Cu) and 12.1 weight % Mg. Solution treatment, hot upset forging, resolutioning and rapid cooling provided initial microstructural homogenization. Subsequent warm rolling was employed to refine the microstructure. The effect of warm rolling parameters of beta particle size and distribution was of particular concern. By warm rolling an alloy containing 10.2 % Mg plus 0.5 % Cu at 250 C, an ultimate tensile strength of 565 MPa (82000 psi), with 11.5% elongation, was achieved with the added advantage of a strength to density ratio higher than present equivalent-strength alloys, such as 7075 T6. GRA

N80-28507# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Engineering.
RAPID SOLIDIFICATION OF A MODIFIED 7075 ALUMINUM ALLOY BY ULTRASONIC GAS ATOMIZATION Technical Report, 1978 - 1979
V. Anand, A. J. Kaufman, and N. J. Grant 24 Mar. 1980 15 p refs Presented at the 2d Intern. Conf. on Rapid Solidification Processing Principles and Technol., Reston, Va., 23-26 Mar. 1980
(Contract N00014-78-C-0385; ARPA Order 3558)
(AD-A085141) Avail: NTIS HC A02/MF A01 CSCL 11/6

Variables associated with ultrasonic gas atomization of aluminum alloys to attain rapid solidification at rates of about ten to the 4th power to ten to the 5th power K/s are discussed. Both structures and properties of some of the alloys produced are shown. GRA

N80-28508# Surrey Univ., Guildford (England). Dept. of Metallurgy and Materials Technology.
STRUCTURE AND BEHAVIOUR OF GRAIN AND PHASE BOUNDARIES Final Report, Jan. 1978 - Jan. 1980
P. J. Goodhew and Z. H. Luklinska Apr. 1980 25 p refs
(Grant DA-ERO-78-G-001; DA Proj. 1T1-61102-BH-57)
(AD-A084880) Avail: NTIS HC A02/MF A01 CSCL 20/2

Thin film bicrystals have been created using gold, silver, palladium and platinum epitaxially grown single crystals. Low angle twist boundaries in all systems consisted of orthogonal sets of lattice dislocations, with character in agreement with the O-lattice theory and earlier less general predictions. High angle boundaries in the Au-Pt system were seen to relax into dislocation networks at temperatures in excess of 600 deg. However, the dislocation directions and spacings could not be interpreted in terms of CSL and NCSL relaxations. All the experiments were rendered more difficult than anticipated because of the difficulties of making the continuous flat single crystals. A critique of the general method of thin film welding for the study of grain boundaries is included. GRA

N80-28509# Harco Corp., Medina, Ohio.
EVALUATION OF CATHODIC PROTECTION CRITERIA Final Report, Jul. 1978 - Apr. 1979
Bernard Husock Dec. 1979 89 p refs
(Contract F08635-77-C-0248; AF Proj. 2104)
(AD-A084783; AFESC/ESL-TR-79-14) Avail: NTIS HC A05/MF A01 CSCL 13/8

This report summarizes the results of a study undertaken to provide an in-depth evaluation of four principal cathodic protection (CP) criteria used for underground and underwater metallic structures. All of the criteria considered make use of structure-to-soil potential measurements. The intent of the report is to provide the background necessary for selecting the proper criterion for a given situation and to remove the misconceptions which often arise. Guidance is provided for correct placement of the reference electrode with respect to the structure being investigated, and for determining how many potential measurements are sufficient. Explanations are given concerning the various voltage (IR) drops which are encountered and instruction is given on how those IR drops are to be considered. It must be understood that there are too many variables to allow for general, all-inclusive statements regarding criteria for cathodic protection. Each application must be reviewed individually using the experience from other similar applications together with the information in this report. GRA

N80-28510# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Materials Engineering.
LOCALIZED CORROSION AND STRESS CORROSION CRACKING BEHAVIOR OF AUSTENITIC STAINLESS STEEL

WELDMENTS CONTAINING RETAINED FERRITE Annual Progress Report, 1 Jun. 1979 - 31 Mar. 1980
W. F. Savage and D. J. Duquette Mar. 1980 9 p refs
(Contract DE-AS02-76ER-02462)
(COO-2462-6) Avail: NTIS HC A02/MF A01

Pitting tests performed on single phase 304 stainless steel alloys and autogeneous weldments containing retained delta ferrite as a second phase show that the presence of delta ferrite decreases localized corrosion resistance with pits initiating preferentially at delta ferrite gamma austenite interphase boundaries. This increased susceptibility is reversible with elevated temperature heat treatments which revert the metastable ferrite phase to the equilibrium austenite phase. These experiments indicate that pitting tendency for both single phase and two phase alloys is controlled by the physical properties of the passive films which are naturally forced. The results of the SCC experiments show that, for two phase alloys at temperatures from 20 C to 290 C, the ferrite phase also significantly affects stress corrosion resistance. The addition of SO4/sup =/ to chloride containing environments has a marked inhibitive effect on SCC. DOE

N80-28511# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
IRRADIATED TYPE 304 SS BEND TEST DUCTILITY
H. D. Garkisch 1980 6 p refs Presented at the Am. Nucl. Soc. Ann. Meeting, Las Vegas, Nev., 8 Jun. 1980
(Contract DE-AC15-76CL-02395)
(CONF-800607-28) Avail: NTIS HC A02/MF A01

A series of tests was performed to determine the available bending deformation capability and ductility of preirradiated Type 304 stainless steel (SS) for core applications. This material was tested under conditions at which it exhibits less ductility than Type 316 SS or other stainless steels currently under considerations for core applications. Tensile testing of Type 304 SS with specimens from EBR-II ducts which were irradiated to fluences between 5 to 10 x 10 to the 22nd power n/sq cm (E > 0.1 MeV) revealed a significant reduction of uniform elongation and total elongation but smaller decreases in reduction of area. These specimens fail with significant but very localized necking. The ductility of this material decreases with decreasing strain rate if the test temperature is above the irradiation temperature. A large reduction in ductility is caused by a change from a transgranular to an intergranular fracture mode. DOE

N80-28512# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
MECHANICAL AND PHYSICAL PROPERTIES OF IRRADIATED TYPE 348 STAINLESS STEEL
J. M. Beeston 1980 45 p refs Presented at the 10th Intern. Symp. on Effects of Radiation on Mater., Savannah, 3 Jun. 1980
(Contract EY-76-C-07-1570)
(CONF-800609-1) Avail: NTIS HC A03/MF A01

A type 348 stainless steel in-pile tube irradiated to a fluence of 3 x 10 to the 22nd power n/sq cm E > 1 MeV (57 dpa), was destructively examined. The service had resulted in a maximum total creep of 1.8% at the high fluence. The metal temperature ranged between 623 K and 652 K, hence the thermal creep portion of the total was negligible. Total creep was greater than anticipated from creep data for austenitic stainless steels irradiated in other reactors. The service-induced changes of mechanical and physical properties were examined, the possibility of adverse effects of both these changes and the greater total creep on the prospective service life of other tubes was assessed. DOE

N80-28513# Illinois Univ., Urbana. Nuclear Engineering Program.
HELIUM-INDUCED BLISTERING AND VOLUME SWELLING IN NICKEL Ph.D. Thesis
George Robert Fenske 1979 165 p refs
(Contract DE-AS02-76ET-52040)
(COO-2218-148) Avail: NTIS HC A08/MF A01

The mechanisms involved in blistering were examined by observing the microstructure of the implanted region using transmission electron microscopy. The volume swelling was measured as a function of the implant depth. The investigation revealed factors important in understanding the mechanisms involved in blister formation. First, measured skin thicknesses was compared with the location of the maximum volume swelling. This demonstrated that the skin separates at the peak swelling depth, not at the end of the swelling profile. Second, the assumptions that were used to predict skin thicknesses were examined. This revealed that the differences between predicted and measured skin thicknesses at low energies can be attributed to: failure to account for volume swelling in the skin, using a Gaussian approximation to the range profile, or one generated with a Monte-Carlo code, and uncertainties in the electronic stopping powers. DOE

N80-28514# Argonne National Lab., Ill. Materials Science Div.
DEVIATION OF LONGITUDINAL AND SHEAR WAVES IN AUSTENITIC STAINLESS STEEL WELD METAL
D. S. Kupperman and K. J. Reimann 1980 16 p refs Presented at 3rd Intern. Conf. on Nondestructive Evaluation in the Nucl. Industry, Salt Lake City, 11-13 Feb. 1980
(Contract W-31-109-eng-38)
(CONF-800231-2) Avail: NTIS HC A02/MF A01

One of the difficulties associated with the ultrasonic inspection of stainless steel weld metal is the deviation of the ultrasonic beams. This can lead to errors in determining both the location and size of reflectors. The present paper compares experimental and theoretical data related to beam steering for longitudinal and shear waves in a sample of 308 SS weld metal. Agreement between predicted and measured beam deviations is generally good. Reasons for discrepancies are discussed. DOE

N80-28515# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
HYDROGEN ASSISTED FRACTURE OF SENSITIZED TYPE 304L AUSTENITIC STAINLESS STEEL
G. R. Caskey, Jr. 1980 25 p refs Presented at 109th Am. Inst. of Met. Engrs. Meeting, Las Vegas, Nev., 24-28 Feb. 1980
(Contracts EY-76-C-09-0001; DE-AC09-76SR-00001)
(DP-MS-79-61; CONF-800205-5) Avail: NTIS HC A02/MF A01

Sensitized specimens of Type 304L stainless steel were tensile tested in atmospheres of hydrogen and helium at high pressure, and in air at ambient pressure. Comparison tensile tests were made with solution annealed specimens of Type 304L stainless steel in the same atmosphere. When both specimens were tested in high pressure hydrogen, the sensitized specimens had greater loss in ductility and increased tendency to intergranular fracture. For the sensitized specimens, plastic strain to failure (epsilon/sub p/ = ln A/A/sub f/) in hydrogen at 69 MPa was reduced by 60 to 70% in comparison to similar tests in helium. In addition, a notch with a stress concentration factor of about 3 reduced plastic strain an additional 50 to 60%. In all cases, the nominal tensile strength of Type 304L stainless steel was increased by the notch. There was no evidence of intergranular failure in notched specimens of solution-annealed Type 304L stainless steel tested in high pressure hydrogen environments. DOE

N80-28516# Battelle Pacific Northwest Labs., Richland, Wash.
FUNDAMENTALS OF CORROSION CONTROL DESIGN
Lyle D. Perrigo and George A. Jensen Mar. 1979 17 p refs Presented at Western Corrosion Seminar, Pomona, Calif., 1-3 May 1979; sponsored by Western Regional Div., Natl. Assoc. of Corrosion Engrs. Revised Submitted for publication
(Contract EY-76-C-06-1830)
(BNWL-SA-5289-Rev; CONF-7905147-1) Avail: NTIS HC A02/MF A01

The development of corrosion control design principles and practice is discussed. It is concluded that by applying simple and straightforward principles to the design of systems, buildings and equipment, operational corrosion problems may be reduced or avoided. These corrosion control design principles are concerned with promoting the use of orientation, layout, and configuration to avoid the holdup of solutions, abrupt flow changes, impingement and stagnant areas. Climatic conditions and terrain are important siting considerations in reducing atmospheric corrosion of buildings and facilities. A determined effort is needed to broaden the understanding of anticorrosion design measures and principles

because these are not widely known and recognized by designers and architects. DOE

N80-28517# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
COORDINATION CHEMISTRY OF METAL SURFACES AND METAL COMPLEXES
Earl L. Muetterties Dec. 1979 17 p refs Presented at the Intern. Congr. on Catalysis, Tokyo, 30 Jun. - 4 Jul. 1980
(Contract W-7405-eng-48; Grant NSF CHE-79-03933)
(LBL-10308; CONF-800615-1) Avail: NTIS HC A02/MF A01

The coordination chemistry of two isometric molecules, acetonitrile and methyl isocyanide, was characterized for (1) single crystal nickel surfaces as a function of crystallography and surface composition, (2) nickel catalyst surfaces, and (3) molecular mononuclear and polynuclear metal complexes. Conditions were established for the catalytic isomerization of methyl isocyanide to acetonitrile within these nickel surface and molecular complex regimes. The acetonitrile and methyl isocyanide chemistry between the surface and molecular complex areas is compared. DOE

N80-28518# Netherlands Organization for Applied Scientific Research TNO, Delft.
FAILURE ANALYSIS
Apeldoorn, Netherlands Metaalinst. TNO 1979 13 p Original contains color illustrations
Avail: NTIS HC A02/MF A01

Brief case histories on metal structures are presented. The following structures are included: an aircraft wheel; an oil storage tank; a drilling platform; a gas turbine; aluminum light standards; and a towbar. Author (ESA)

N80-28519# Foerenade Fabriksverken, Linkoeping (Sweden). Materials Lab.
FRETTING TESTS OF TITANIUM ALLOY Ti-6Al-4V WITH SHOT-PEENED AND SOLID LUBRICANT COATED SURFACES
Gunnar Burman 28 Feb. 1979 16 p ref
(Contract FMV-FMO-82302-78-000-00-019)
(FFV-R-9581-0316-1) Avail: NTIS HC A02/MF A01

Specimens of Ti-6Al-4V titanium alloy were fatigue tested under fretting conditions. Two groups of specimens were tested, one containing shot-peened specimens and the other containing specimens that were shot-peened and coated with the solid lubricant PWA 474. Rotary bending fatigue tests were performed. Under fretting conditions, the fatigue limit for shot-peened specimens was 235 N/sq mm, while the corresponding value for shot-peened and solid lubricant coated specimen was 480 N/sq mm. The fatigue limit for the latter group of specimens approaches that of material unaffected by fretting. It is shown that shot-peening combined with solid lubricant coating drastically improves the fatigue strength of the material under the fretting conditions used in this investigation. Author (ESA)

N80-28520# National Technical Information Service, Springfield, Va.
CRYOGENIC PROPERTIES OF ALUMINUM AND ALUMINUM ALLOYS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1980
Brian Carrigan Apr. 1980 159 p Supersedes NTIS/PS-79/0507; NTIS/PS-78/0511
(PB80-809593; NTIS/PS-79/0507; NTIS/PS-78/0511) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Citations of Federally funded research include studies on the cryogenic properties of aluminum and its alloys used in superconducting machinery, magnets, space technology, and nuclear reactors. Electrical properties, fatigue, deformation, and welds are included. This updated bibliography contains 153 abstracts, 8 of which are new entries to the previous edition. GRA

N80-28521# National Technical Information Service, Springfield, Va.
CRYOGENIC PROPERTIES OF ALUMINUM AND ALUMINUM ALLOYS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1980
Brian Carrigan Apr. 1980 128 p Supersedes NTIS/PS-78/0512
(PB80-809601; NTIS/PS-79/0508; NTIS/PS-78/0512) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Reports of worldwide research on aluminum and its alloys in liquefied gas tanks, superconducting devices, pressure vessels, and spacecraft components are cited. Studies on welds, fracture, and mechanical properties are included. This updated bibliography contains 122 abstracts, 21 of which are new entries to the previous edition. GRA

N80-28522# Rockwell International Corp., Thousand Oaks, Calif. Science Center.
MECHANISM OF SO2 AND H2SO4 AEROSOL ZINC CORROSION Final Report, 9 May - 9 Jun. 1979
Alan B. Harker, Florian B. Mansfeld, Dennis R. Strauss, and Dwight D. Landis Jan. 1980 42 p refs
(Contract EPA-68-02-2944)
(PB80-167018; EPA-600/3-80-018) Avail: NTIS HC A03/MF A01 CSCL 07D

The physical variables controlling the SO2 and H2SO4 induced corrosion of zinc were investigated. Relative humidity, temperature, air flow velocity, flow turbulence, aerosol size range, and pollutant concentration were controlled. Corrosion measurements were made through the use of an atmospheric corrosion monitor. The results show that the principal factors controlling pollutant induced corrosion are relative humidity, the rate of pollutant flux to the surface, and the chemical form of the pollutant. Sulfur dioxide was observed to induce a higher corrosion rate in the zinc than H2SO4 on a molecule for molecule basis. The overall results indicate that under most ambient conditions SO2 induced corrosion damage will dominate over H2SO4 effects. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-28523 Washington State Univ., Pullman.
SYNTHESIS, STRUCTURE AND PROPERTIES OF ORGANOMETRIC MONOMERS AND POLYMERS Ph.D. Thesis
Russell Samuel Williams 1980 126 p
Avail: Univ. Microfilms Order No. 8015170

The relationship between bulk properties of thermoset organotin polymers and structural changes due to various methods of bonding tri-n-butyltin esters to the polymer matrix is examined. Two synthetic methods were explored to prepare such polymers. In the first, tri-n-butyltin (TBT) esters of compounds such as 4,4'bis(4-hydroxyphenyl) pentanoic acid were prepared and then condensed with epichlorohydrin to give a TBT modified diepoxide. In the second synthesis, the formation of undesirable byproducts could be avoided by chemically binding the TBT moiety to amine curing agents. Several organometallic compounds were synthesized including tri-n-butyltin esters of glycine, 4-aminobutanoic, 6-aminohexanoic, 11-aminoundecanoic, and 3,5-diaminobenzoic acids. DGEBA was cured either with these amines individually (as in the case if TBT 3,5-diaminobenzoate) or in combination with other multifunctional amines. Mechanical testing indicated a dependence of strength, modulus, toughness, and glass transition depending on the location of the TBT moiety in relation to the polymer backbone. Dissert. Abstr.

N80-28524*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CHARACTERIZATION OF PMR-15 POLYIMIDE COMPOSITION IN THERMO-OXIDATIVELY EXPOSED GRAPHITE FIBER COMPOSITES
William B. Alston 1980 19 p refs Proposed for Presentation at 12th Natl. SAMPE Tech. Conf., Seattle, 7-9 Oct. 1980
(NASA-TM-81565; AVRADCOM-TR-80-C-10; E-527) Avail: NTIS HC A02/MF A01 CSCL 09C

The contributions of individual resin components to total resin weight loss in 600 F air aged Celion 6000/PMR-15 polyimide composites were determined from the overall resin weight loss in the composite by chemically separating the PMR-15 matrix resin into its monomeric components. The

individual resin components were also analyzed by spectroscopic techniques in order to elucidate curing and degradation mechanisms of the PMR-15 matrix resin. The isothermal weight loss of the individual resin components during prolonged 600 F thermo-oxidative aging of the composite was correlated to the changes observed in the Fourier Transform infrared spectra and Fourier Transform nuclear magnetic resonance spectra of the individual resin components. The correlation was used to identify the molecular site of the thermo-oxidative changes in PMR-15 polyimide matrix resin during 600 F curing the prolonged 600 F thermo-oxidative aging. Author

N80-28525# De Soto, Inc., Des Plaines, Ill.
WATERBORNE POLYMERIC FILMS Interim Report, 15 Sep. 1978 - 15 Sep. 1979
A. J. Tortorello and R. T. Gearon Wright-Patterson AFB, Ohio AFML Dec. 1979 109 p refs
(Contract F33615-78-C-5096; AF Proj. 2422)
(AD-A084838; AFML-TR-79-4192) Avail: NTIS HC A06/MF A01 CSCL 11/3

Air Force Materials Laboratory contract proposed the development of a high performance water based polymer system to function as a pigment binding vehicle for military aircraft coatings. Screening studies on numerous commercially available aqueous resin systems enabled a ranking based on clear-film performance. A few resins were identified as displaying performance approaching the established criteria. Aqueous polyurethanes, aqueous acrylic solution polymers, and epoxy emulsions exhibited near acceptable fluid resistance and flexibility. One member of the class of water reducible alkyds exceeded the performance of other resins in this class. The selected resins were subjected to pigmentation studies. Primer formulations using strontium chromate pigment were prepared and evaluated. Topcoat formulations with rutile titanium dioxide were also prepared and evaluated. Results of clear and pigmented film studies indicate that the class of aqueous polyurethane dispersions would be most likely to meet the required fluid resistance and flexibility. Aqueous acrylic solution polymers successfully resisted the test fluids but flexibility was lacking. GRA

N80-28526# Albany International Corp., Dedham, Mass.
KEVLAR PROPERTIES INVESTIGATION HIGH SPEED ABRASION RESISTANCE Final Report, 13 Feb. 1978 - 31 Jan. 1980
Stephen L. Goodwin and Norman J. Abbott AFWAL Wright-Patterson AFB, Ohio Feb. 1980 169 p refs
(Contract F33615-78-C-3406; AF Proj. 2402)
(AD-A085155; AFWAL-TR-80-3004) Avail: NTIS HC A08/MF A01 CSCL 11/9

Kevlar has acquired a reputation for poor abrasion resistance. Replacement of nylon parachute materials with Kevlar has been hampered by Kevlar's reputation. However, abrasion testing of these materials under conditions designed to simulate parachute deployment had never been performed. A test procedure was designed to simulate the high speed rubbing of Kevlar and nylon webbings, braids and ribbons against themselves and a common abrasive surface under various conditions of loading at speeds ranging from 20 to 240 fps. Evaluation of abrasive damage was based upon strength loss for each material at each test condition. Extensive testing of both Kevlar and nylon materials showed conclusively that Kevlar's resistance to abrasive damage sustained due to high speed rubbing was superior to that of nylon. Investigation of the effects of many test parameters on strength loss due to abrasive damage showed that Kevlar relative to nylon was much less affected by test speed and normal force due to its superior thermal stability. GRA

N80-28527# Chemetal Corp., Pacoima, Calif.
INVESTIGATION OF CNTD SILICON NITRIDE ON COMPLEX SHAPES Final Report, 1 Jul. 1978 - 1 Jul. 1979
Robert A. Holzl 6 Feb. 1980 76 p refs
(Contract F33615-78-C-5161)
(AD-A085153; AFML-TR-79-4219) Avail: NTIS HC A05/MF A01 CSCL 11/3

The project reported on herein represents an attempt to extend the technique of CVD to the efficient, economical, one step coating of complex shapes. A limitation in state of the art CVD processing is that planar of axisymmetric shapes are required if coatings having uniform thickness and consistent properties are desired. It was therefore proposed to design, build and test a deposition chamber in which a complex shape such as a turbine blade or vane could be reproducibly and evenly coated on all surfaces in one operation. The present report describes the rationale for the chamber design, experiments leading to the demonstration of its capabilities, and the characterization of the resulting Si3N4 coatings which were deposited on RBSN turbine vanes. A complete description of the chamber and ancillary equipment is given. GRA

N80-28528# Union Carbide Corp., Tarrytown, N.Y.
ORGANOSILANE POLYMERS. 3: BLOCK COPOLYMERS
J. P. Wesson and T. C. Williams Apr. 1980 21 p refs
(Contract N00014-75-C-1024)
(AD-A085202; TR-79-1-3) Avail: NTIS HC A02/MF A01 CSCL 11/9

Block copolymers made by coupling chloro and lithio terminated diorganosilylene oligomers were soluble in common solvents and deposited coherent films from solutions. Copolymer UV spectra showed a red shift in absorption maxima attributed to increased silicon chain length and phenyl-silicon spine interaction. GRA

N80-28529# Utah Univ., Salt Lake City.
APPLICATION OF RATE THEORY TO ACCELERATED DURABILITY TESTING OF STRUCTURAL ADHESIVES Final Report, summer 1978
William L. Hufford Mar. 1980 74 p refs
(Contract F33615-72-C-5003)
(AD-A085142; AFML-TR-79-4199) Avail: NTIS HC A04/MF A01 CSCL 11/1

The application of absolute reaction rate theory concepts is explored as a scientific basis for establishing an accelerated testing methodology for adhesive bonded joints. Primary attention is given to the effects of time, moisture, temperature and load history. Some of the more dominant processes occurring during cure and aging of epoxy resin adhesives are identified and potential techniques for separating and monitoring the associated activation energies of these mechanisms with aging, environment and load history are discussed. Suggestions are also made for incorporating aging effects into appropriately rigorous constitutive models. GRA

N80-28530# Naval Civil Engineering Lab., Port Hueneme, Calif.
LIGHTWEIGHT CONCRETE USING POLYMER-FILLED AGGREGATE FOR OCEAN APPLICATIONS: AN EXPLORATORY INVESTIGATION Final Report, Sep. 1978 - Sep. 1979
Harvey H. Haynes and Wulf V. Eckroth Dec. 1979 30 p refs
(ZF61512001)
(AD-A085287; CEL-TN-1765) Avail: NTIS HC A03/MF A01 CSCL 11/2

A lightweight concrete specially suited for deep ocean applications was tested for its strength properties and compared to similar regular lightweight concrete. The new concrete used lightweight aggregate particles (expanded shale) which were filled with a polymeric material. The polymer-filled aggregate (PFA) was conventionally mixed with portland cement and water to make the lightweight concrete. Four concrete mixes were tested. In general, the PFA concrete, compared to regular lightweight concrete, has an equal unit weight in a seawater saturated condition and exhibited increases in compressive strength of 26%, split tensile strength of 4%, elastic moduli of 4% and an equal Poisson's ratio. The strongest mix for PFA concrete had a compressive strength of 6,580 psi, compared to 5,200 psi for regular lightweight concrete, at an age of 28 days under continuous fog curing. Both mixes have a weight savings of 40%, compared to that of normal weight concrete in a submerged, saturated condition. A discussion of cost is presented and shows that the in-place structural cost of PFA concrete would be about 30% greater than normal concrete. GRA

N80-28531# Effects Technology, Inc., Santa Barbara, Calif.
LOCALIZED DEFORMATION AND FRACTURE OF TRANSPARENT CERAMICS
William F. Adler and Timothy W. James Mar. 1980 93 p refs

(Contract N00014-76-C-0744; ONR Proj. 471)
(AD-A085133; ETI-CR80-758) Avail: NTIS HC A05/MF A01 CSCL 11/2

The objective of this research is to understand and model the deformation and fracture response of materials exposed to water drop collisions. Due to the inherent complexity of the erosive response of materials exposed to a multiple water drop environment, this investigation concentrated on a very idealized water drop impact condition: the normal impact of a spherical water drop on a plane surface. Impact experiments were conducted in a specially designed ballistic range facility capable of producing spherical water drop impacts on materials at impact velocities from 200 to 850/ms. A reproducible, controlled, and well-characterized impact condition is necessary if an accurate assessment of the material's response is to be established and this requirement has been satisfied within this program. The water drop impact damage on single crystal and polycrystalline calcium fluoride was also investigated. Some general observations are made with regard to the form of the fractures in extruded, hot-pressed, and press-forged calcium fluoride. GRA

N80-28532# Rensselaer Polytechnic Inst., Troy, N. Y.
PROPERTIES OF GLASSES WITH HIGH WATER CONTENT Progress Report, 15 Jun. 1979 - 29 Feb. 1980
Minoru Tomozawa and Edward Bruce Watson Mar. 1980 12 p refs
(Contract DE-AC02-79ER-10453)
(DOE/ER-10453/01) Avail: NTIS HC A02/MF A01

In this initial stage of the research on glasses with high water content, the hydrothermal units were constructed and several water bearing sodium silicate glasses were prepared. Preliminary measurements were also made on thermal, mechanical, and electrical properties of these glasses. Several unique features were revealed. For example, the electrical resistivity increases substantially with water content suggesting a possibility of preparing chemically durable glasses with large amounts of water. DOE

N80-28533# Associated Technical Services, Inc., Glen Ridge, N. J.
POLYMERIZATION IN SHOCK COMPRESSION
L. V. Babare (Academy of Science, USSR), A. N. Dremin (Academy of Science, USSR), S. V. Pershin (Academy of Science, USSR), and V. V. Yakovlev (Academy of Science, USSR) Apr. 1980 18 p refs Transl. into ENGLISH of Russian conf. paper, Moscow 1970 p 239-257 *Presented at 1st Intern. Symp. on Explosive Cladding, Moscow, 1971* Sponsored by DOE Prepared for Sandia Labs., Albuquerque, N. Mex.
(SAND-80-6006) Avail: NTIS HC A02/MF A01

A fairly wide range of liquid and crystalline monomers was subjected to polymerization (up to pressures of 100 kbar), and the range in which the process occurs with some of them was established. It was shown that polymerization occurs both with polymers polymerizing under ordinary conditions by the radical or the ionic mechanism, and that it can take place at a double or triple bond, as well as with ring opening. Under specific conditions of shock compression, polymerization can be accomplished with compounds normally difficult or impossible to polymerize. It was shown that polymerization takes place within a few milliseconds, at pressures at which the density of the monomer reaches that of the polymer. The effect of pressure in shock compression and the number of reflected waves on the yield and length of the resulting polymeric chain was studied. Conductivity was observed in the region of polymerizing pressures. It was found that the action of the shock wave does not rest mainly on thermal effects but is determined by the specific nature of the shock loading. DOE

N80-28534# Propellants, Explosives and Rocket Motor Establishment, Waltham Abbey (England).
THE WEATHERING OF PLASTIC MATERIALS IN THE TROPICS. PART 3: THE EVALUATION OF A SOLAR RADIATION CONCENTRATION DEVICE (EMMA) AS A MEANS OF ACCELERATING THE WEATHERING OF PLASTICS
London HMSO Jun. 1979 34 p refs
(BR68706) Avail: NTIS HC A03/MF A01

An experiment was conducted in Phoenix to compare the rate of natural weathering with that for exposure on EMMA (equatorial mount with mirror for acceleration), a device which increases the intensity of solar radiation. The materials exposed were low density polyethylene and polyacetal. An acceleration factor of about two was found for both materials. Author (ESA)

N80-28535# National Technical Information Service, Springfield, Va.
FRACTURE OF CERAMICS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Mar. 1980
Guy E. Habercom, Jr. Apr. 1980 208 p Supersedes NTIS/PS-79/0307; NTIS/PS-78/0264
(PB80-809825; NTIS/PS-79/0307; NTIS/PS-78/0264) Avail: NTIS HC $30.00/MF $30.00 CSCL 11B

Citations of research on ceramic fracture in relation to fabrication, microstructure, mechanical properties, tests, and composition are covered in this bibliography. Reports include ceramic use in rocket components, gas turbines, nuclear reactors and structural parts. This updated bibliography contains 201 abstracts, 59 of which are new entries to the previous edition. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-28536* National Aeronautics and Space Administration. Pasadena Office, Calif.
SILICONE CONTAINING SOLID PROPELLANT Patent
Kumar N. R. Ramohalli, inventor (to NASA) (JPL) Issued 1 Jul. 1980 4 p Filed 16 Oct. 1978 Supersedes N79-10224 (17 - 01, p 0030)
(NASA-Case-NPO-14477-1; US-Patent-4,210,474; US-Patent-Appl-SN-951830; US-Patent-Class-149-19.2; US-Patent-Class-149-19.9; US-Patent-Class-149-20) Avail: US Patent and Trademark Office CSCL 21I

The addition of a small amount, for example 1% by weight, of a liquid silicone oil to a metal containing solid rocket propellant provides a significant reduction in heat transfer to the inert nozzle walls. Metal oxide slag collection and blockage of the nozzle are eliminsted and the burning rate is increased by about 5% to 10% thus improving ballistic performance.

Official Gazette of the U.S. Patent and Trademark Office

N80-28537# Naval Surface Weapons Center, White Oak, Md.
SYNTHESIS OF ENERGETIC MATERIALS AT HIGH PRESSURE Annual Technical Report, FY 1979
William M. Koppes and Horst G. Adolph Mar. 1980 36 p refs
(RR0240201)
(AD-A084800) Avail: NTIS HC A03/MF A01 CSCL 19/1

The utility of a high pressure technique to effect the trimerization of fluorodinitroacetonitrile to the corresponding triazine has been investigated. Whereas fluorodinitroacetonitrile has resisted previous ambient pressure attempts at trimerization with a variety of catalysts, it was found to form triazines quite readily when subjected to 1 GPa pressures in the presence of certain primary alcohols and phenols. However, the triazines formed contained a mixture of fluorodinitromethyl and alkoxy or aryloxy substituents, apparently as a consequence of competition between $CF(NO_2)_2$ and ROH for elimination in the cyclization steps, or of nucleophilic displacement of $CF(NO_2)_2$ by ROH in the initial triazine product. A study was made of the effect of ROH acidity on product composition with the finding that mixed triazines formed in all cases in which reaction occurred. An alternative mechanisms for triazine formation from nitriles was postulated to account for some novel observations made during this work. Our results indicate that tris (fluorodinitromethyl) triazine must be highly susceptible to nucleophilic attack with displacement of at least one $CF(NO_2)_2$ group, and would thus be subject to easy hydrolysis. GRA

N80-28538# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
GRAIN MODIFICATION ADDITIVES FOR TNT AND ITS COMPOSITIONS. A PRELIMINARY SCREENING VIA SUPPRESSION OF SUPERCOOLING
S. Portnoy Jun. 1980 20 p refs
(AD-A085019; AD-E400426; ARLCD-MR-8001) Avail: NTIS HC A02/MF A01 CSCL 19/1

A preliminary search for alternatives to 2,2',4,4',6,6'-hexanitrostilbene, as grain modification additives for TNT and its compositions, has been made. Screening of candidate additives was based upon the determination, via differential scanning calorimetry (DSC), of the suppression of supercooling by 0.5% of additive. A cast of good quality was obtained with 5-nitrobarbituric acid trihydrate. GRA

N80-28539# Crew Systems Consultants, Yellow Springs, Ohio.
FLIGHT TEST RESULTS OF THE USE OF ETHYLENE GLYCOL MONOMETHYL ETHER (EGME) AS AN ANTI-CARBURETOR ICING FUEL ADDITIVE Final Report
Richard L. Newman Jul. 1979 66 p
(Contract DOT-FA78WA-4165)
(AD-A084960; TR-79-9; FAA-AWS-79-1) Avail: NTIS HC A04/MF A01 CSCL 21/4

Flight test results of Ethylene Glycol Monomethyl Ether (EGME) show that EGME reduces the formation of carburetor ice during cruise power, and that the effectiveness of EGME reduces as the throttle is closed. Based on these results, EGME should not be considered as an anti-carburetor icing fuel additive in lieu of carburetor heat. GRA

N80-28540# Naval Surface Weapons Center, White Oak, Md.
DDT BEHAVIOR OF POROUS PROPELLANT MODELS AND POROUS SAMPLES OF COMMERCIAL PROPELLANTS
Donna Price and Richard R. Bernecker 13 Mar. 1980 45 p refs
(ZR0130901)
(AD-A084906; NSWC/TR-80-65) Avail: NTIS HC A03/MF A01 CSCL 21/9

A number of binary mixtures, components of which are propellant ingredients, were examined in steel walled tubes for their DDT behavior at 60-70% theoretical maximum density (TMD). Several commercial propellants and one 4 component, composite model were also examined. A number of compositional effects were noted and reported. Some propellants, at high porosity, showed reaction not detectable by our ionization probes. For propellants which exhibited transition at 70% TMD in our apparatus, the range in predetonation column length (l) was 103-170 mm and in relative time to detonation, 76-247 micro. GRA

N80-28541# Whittaker Corp., North Hollywood, Calif. Shock Hydrodynamics Div.
PROJECTILE IMPACT IGNITION CHARACTERISTICS OF PROPELLANTS Final Report, 1 Sep. 1976 - 30 Nov. 1979
W. H. Andersen May 1980 24 p refs
(Contract DAAG29-76-C-0063)
(AD-A085254; Rept-3420-FARO-14396.10-E) Avail: NTIS HC A02/MF A01 CSCL 21/9

The results of an investigation of the projectile impact ignition characteristics of propellants are described. Impact tests were conducted on a single, double and triple base propellant, and a deflagratable composite explosive. The tests were conducted by firing different diameter, flat-nosed brass projectiles into small cylinders of the propellant at various velocities and observing the impact reaction by various sensors. The general behavior of the four materials to impact was the same. The critical impact velocity necessary to induce a sustained reaction in a propellant decreased with increasing projectile diameter. The nature of the reaction depended on the diameter. At small diameters, the induced reaction was always detonation; whereas at the largest diameter the reaction was deflagration, whose intensity increased with increasing impact velocity. A higher critical velocity then again resulted in detonation. A model based on the view that the ignition and reaction in an impacted (shocked) propellant are independent processes was postulated to explain the results. The critical velocity for inducing ignition was consistent with the critical energy concept. GRA

N80-28542# Badger Plants, Inc., Cambridge, Mass.
ASPECTS OF COMMERCIALIZING COAL-DERIVED METHANOL FUELS IN THE UNITED STATES, 1985 TO 2000. VOLUME 1: MARKET EVALUATION
Mar. 1980 173 p refs
(Contract EX-76-C-01-2416)
(FE-2416-44-Vol-1) Avail: NTIS HC A08/MF A01

The prospects of coal derived fuels are evaluated only for those segments of the electric utility and automotive sectors considered most likely to provide markets for such fuels in the near term. The commitment of the electric utility industry to the use of methanol as a peakload turbine fuel is predicted upon both future and price supply. Results indicate that methanol appears to be an acceptable replacement gas turbine fuel and that the technical problems should be solvable. DOE

N80-28543# Badger Plants, Inc., Cambridge, Mass.
ASPECTS OF COMMERCIALIZING COAL-DERIVED METHANOL FUELS IN THE UNITED STATES, 1985 TO 2000. VOLUME 2: APPENDIX
Mar. 1980 231 p refs
(Contract EX-76-C-01-2416)
(FE-2416-44-Vol-2) Avail: NTIS HC A02/MF A01

Various aspects of the commercializing of methanol fuel and synthetic gasoline in the United States during the period 1985 to 2000 are evaluated. Major emphasis is placed on electric utility industry and the automotive sector. Competing alternative fuels are also reported. R.C.T.

N80-28544# Air Products and Chemicals, Inc., Allentown, Pa.
LIGHTWEIGHT METAL HYDRIDES MATERIALS DEVELOPMENT Final Report
Apr. 1980 42 p
(Contract EY-76-C-02-0016)
(DOE/CS-0016/T1) Avail: NTIS HC A03/MF A01

A four month program was initiated with the following objectives: (1) to define the products of the hydriding reaction of the Mg5Al8/H2 system (phase 1), and (2) explore the roles and functions of Ni as a catalyst for hydriding the Mg5Al8 system (Phase 2). Phase 1 results indicated that the hydrided alloy rearranges the form pockets of MgH2 and Al, no ternary hydride was formed. Additional evidence was obtained to support our hypothesis that the disproportionation of Mg5Al8 may be the rate limiting step for the hydrogen absorption reaction. In Phase 2 three forms of Ni incorporation were considered. The data showed that Ni does not significantly increase the rate of hydrogen absorption for the Mg5Al8/Ni systems. However, Ni does enhance the rate of hydrogen desorption, suggesting there are different rate limiting steps for absorption and desorption. Further work in the area of Ni-catalysis is warranted to increase the odds of developing a workable, light weight, hydride system exhibiting attractive desorption kinetics. DOE

N80-28545# Delaware Univ., Newark. Dept. of Chemical Engineering.
DEVELOPMENT OF UNIQUE CATALYSTS FOR HYDRODENITROGENATION OF COAL-DERIVED LIQUIDS Quarterly Report, 15 Dec. 1978 - 15 Mar. 1979
James R. Katzer, Alvin B. Stiles, and Harold Kwart 15 May 1979 31 p
(Contract ET-78-S-01-3297)
(FE-3297-2; QR-2) Avail: NTIS HC A03/MF A01

Experimental runs using decahydroquinoline, o-ethylaniline, and aniline as reactants were made. Results from decahydroquinoline runs show that carbon-nitrogen bond scission occurs by a catalytic route; it is not thermal. Strong Bronsted acid sites do not crack carbon-nitrogen bond; carbon-nitrogen bond scission must therefore occur on other sites on the catalyst. Hydrodenitrogenation of anilines clearly shows kinetic behavior characteristic of hydrogenation including positive order dependence on hydrogen pressure and an activation energy between that for hydrogenation and that for cracking; yet the primary product appears to be the fully aromatic ring. Hydrodenitrogenation of aniline and o-ethylaniline was studied over a presulfided Ni-Mo/Al2O3 catalyst, and a reaction network was determined for aniline hydrodenitrogenation. Aniline hydrodenitrogenation appears to involve partial hydrogenation of the benzene ring to reduce

aromatic resonance with the nitrogen atom reducing the C-N bond strength and facilitating elimination of NH3. DOE

N80-28546# Delaware Univ., Newark. Dept. of Chemical Engineering.
DEVELOPMENT OF UNIQUE CATALYSTS FOR HYDRODE-NITROGENATION OF COAL-DERIVED LIQUIDS Quarterly Report, 15 Mar. - 15 Jun. 1979
James R. Katzer, Alvin B. Stiles, and Harold Kwart 1 Aug. 1979 57 p
(Contract ET-78-S-01-3297)
(FE-3297-3; QR-3) Avail: NTIS HC A04/MF A01

Experimental runs using decahydroquinoline and quinoline as reactants were made. The nature of catalytic function responsible for carbon-nitrogen bond session was studied using decahydroquinoline over a set of catalysts. The catalysts tested include catalysts with Co, Ni, Mo impregnated on silica-alumina or gamma-alumina. The results showed that the rate of nitrogen removal and highest for Mo on gamma-alumina catalyst. Several catalysts with the objective to develop uniquely new hydrogeration catalysts that will selectively coordinate the nitrogen atom and remove it without hydrogenating the entire ring thereby reducing hydrogen consumption, were prepared. The catalysts chosen were aluminum borate and aluminum borate phosphate, impregnated with 4 wt % nickel. Preliminary results showed that 4 wt % Ni on aluminum borate catalyst gives a marked increase in nitrogen removal in quinoline. DOE

N80-28547# Los Alamos Scientific Lab., N. Mex.
ALTERNATIVE GAS WORKSHOP Final Report
Glenda Cremer, comp. Mar. 1980 58 p refs Workshop held at Los Alamos, N. Mex., 5-8 Sep. 1979
(Contract W-7405-eng-36)
(LA-8155-C; CONF-7909133) Avail: NTIS HC A04/MF A01

Basic research needs in the development of seven categories of unconventional and nonconventional gas resources were reviewed. The categories reviewed were Devonian shales, western tight gas sands, methane from coal beds, geopressured brines, methane hydrates, abiogenic methane, and other geological environments. The principal recommendations of the workshop groups are presented. DOE

N80-28548# Air Products and Chemicals, Inc., Allentown, Pa.
CRYOGENIC METHANE SEPARATION/CATALYTIC HYDROGASIFICATION PROCESS ANALYSIS Interim Report
A. A. Cassano, M. F. Hilton, and T. C. Li 15 May 1979 98 p refs
(Contract ET-78-C-01-3044)
(FE-3044-T6) Avail: NTIS HC A05/MF A01

Attractive combinations of acid gas removal and cryogenic methane separation for both the catalytic coal gasification and the hydrogasification processes are suggested. A screening process was undertaken to define the most promising integration scheme for each gasification process. This information, combined with present capabilities in acid gas processes and cryogenic separation, allowed preparation of process designs and cost estimates for each of the integrated schemes. DOE

N80-28549# Ames Lab., Iowa.
MATERIALS FOR COAL LIQUEFACTION
Tom E. Scott Oct. 1979 71 p refs Presented at the 4th Ann. Conf. on Mater. for Coal Conversion and Utilization, Gaithersburg, Md., 9-11 Oct. 1979; sponsored by DOE, Electric Power Research Inst., NBS and Gas Research Inst.
(Contract W-7405-eng-82)
(ISM-246; CONF-791014-1) Avail: NTIS HC A04/MF A01

An attempt is made to summarize the failures already experienced, most of which are highly visible such as erosion or corrosion. Problems which are not failures but bear on cost effectiveness as well as potential problems which might effect reliability and safety are indicated. The efforts being made to solve these problems are cited and some future directions for consideration are suggested. It is shown that solutions to problems uncovered in pilot plant scale operations may not suffice in commercial scale plants. On the other hand, some pilot plant problems may be eliminated or mitigated in large components for commercial plants. DOE

N80-28550# Chevron Research Co., Richmond, Calif.
REFINING AND UPGRADING OF SYNFUELS FROM COAL AND OIL SHALES BY ADVANCED CATALYTIC PROCESSES Quarterly Report, Apr. - Jun. 1979
R. F. Sullivan and D. J. Rear Jul. 1979 79 p
(Contract EX-76-C-01-2315)
(FE-2315-40) Avail: NTIS HC A05/MF A01

Pilot plant results for a two stage hydrocracker are presented. It is shown that H-coal whole process product can be hydrotreated to make a jet fuel similar to the jet fuel from SRC-2 whole process product. DOE

N80-28551# Engineering Societies Commission on Energy, Inc., Washington, D. C.
SURVEY OF WORLD COAL ENERGY STUDIES AND INTERNATIONAL COAL MINING RESEARCH
T. A. Boyce Dec. 1979 80 p
(Contract EF-77-C-01-2468-012)
(FE-2468-68) Avail: NTIS HC A05/MF A01

An international monitoring task was undertaken with emphasis on monitoring the awareness of international energy programs. The findings of the monitoring activities are summarized with respect to the following: world coal energy studies; international coal mining research; and world coal trade. DOE

N80-28552# Germantown Labs., Inc., Philadelphia, Pa.
INVESTIGATION OF FUELS CONTAINING COAL-OIL-WATER EMULSIONS FIRE TUBE TEST APPARATUS Quarterly Report, 1 Jan. - 31 Mar. 1980
Norman H. Cherry and Charles S. Stokes Jan. 1980 12 p
(Contract DE-ACZ2-77ET-10634)
(DOE/ET-10634/T1; QR-10) Avail: NTIS HC A02/MF A01

The fire tube test apparatus was checked out and is ready for the combustion test series. The stack gas analysis equipment was calibrated and operational procedures evaluated for data acquisition. In conjunction with the fire tube test apparatus, a commercial scale size Gaulin emulsifier (100 gallons/hour) was set up and evaluated. DOE

N80-28553# Filtrol Corp., Los Angeles, Calif.
DEVELOPMENT OF NEW CATALYSTS FOR COAL LIQUIDS REFINING Quarterly Report, 1 Jul. - 30 Sep. 1979
I. Schwager Oct. 1979 27 p refs
(Contract ET-78-C-01-2595)
(FE-2595; QR-3) Avail: NTIS HC A03/MF A01

Base line catalyst testing conditions for hydrotreating SRC-2 fuel oil blend were determined: temperature, 750 F; pressure, 1,000 psig; LHSV, 1 ml/ml-hr; and H2 flow rate, 5000 SCF/bbl. At these conditions the average values for HDN and HDS with the commercial Filtrol catalyst HPC-40 (Ni-Mo on gamma alumina) are 88 + or - 2 and 89 + or - 2%, respectively. With Filtrol HP-6 (Co-Mo on gamma alumina) the HDN and HDS values are 78 and 92%, respectively. Hydrotreating catalyst testing on a series of exploratory catalysts, with different metals loadings and support properties, was initiated. Nickel-molybdenum catalysts appear to be more active for HDN, whereas, Co-Mo catalysts appear to be more active for HDS. Both Ni-W and Co-W catalysts appear to be less active than their Ni- and Co-Mo counterparts. Pilot Plant batches of silica alumina, silica alumina magnesia, and silica alumina zirconia gels were prepared. Exploratory cracking, hydrocracking, and hydrotreating catalysts are being produced in preparation for activity testing. DOE

N80-28554# Lummus Co., Bloomfield, N. J.
DEVELOPMENT RESEARCH PROGRAM FOR CLEAN INDUSTRIAL AND TRANSPORTATION FUELS FROM COAL Final Report, Sep. 1976 - Mar. 1979
H. D. Schindler and R. H. Long Dec. 1979 171 p refs
(Contract EF-76-C-01-2514)
(FE-2514-31) Avail: NTIS HC A08/MF A01

The potential performance of single axis tracking parabolic trough solar collectors as a function of optical energy distribution and receiver size was calculated for eleven sites using typical meteorological year input data. A simulation based on the SOLTES code was developed which includes the three dimensional features of a parabolic trough and calculates the thermooptical tradeoffs. The capability of the thermooptical model was confirmed by the comparison of calculated results with the experimental results

from an all day test of a parabolic trough. The results indicate a potential performance superiority of a north-south horizontal axis trough and, in addition, a high quality (optical error sigma sub system less than or equal to 0.007 radian) collector should be of the same geometric design for all of the sites investigated and probably for all regions of the country. DOE

N80-28556# Worcester Polytechnic Inst., Mass.
KINETICS AND MECHANISMS OF CATALYTIC HYDROLIQUEFACTION AND HYDROGASIFICATION OF LIGNITE Quarterly Report, Jul. - Sep. 1979
Alvin H. Weiss and Wilmer L. Kranich 25 Oct. 1979 8 p
(Contract EF-77-S-01-2702)
(FE-2702-8) Avail: NTIS HC A02/MF A01

Several successful runs on hydrogenation of a 20% slurry of lignite in anthracene oil were made at 425 C in a CSTR. At constant concentration of unconverted coal solids, the rate of reaction appears from very limited data to be independent of hydrogen pressure over a total pressure range of 800 to 1600 psig. Rate also appears to be independent of concentration of Co-Mo catalyst over the range of 0.8% to 2.0% of total charge. If these results can be reproduced and extended, this may indicate that over these ranges, hydrogen is supplied and activated by the catalyst at a rate well in excess of that at which it can be utilized by the slower hydroliquefaction reactions. DOE

N80-28558# Oklahoma State Univ., Stillwater. School of Chemical Engineering.
CATALYSTS FOR UPGRADING COAL-DERIVED LIQUIDS Quarterly Report, 1 Jan. - 31 Mar. 1980
Billy L. Crynes 15 Apr. 1980 18 p
(Contract DE-AC01-79ET-14876)
(DOE/ET-14876/2) Avail: NTIS HC A02/MF A01

Construction of the new trickle-bed reactor was completed and one experiment was conducted. The experimental run was made using a Pamco coal-derived liquid containing 0.40% sulfur and 0.95% nitrogen. The catalyst utilized was HDN-30, Ni-Mo-Al2O3. Run conditions were at 399 C (750 F), 1500 psig and space times up to two hours. Sample analyses are not yet available from this experiment. Two runs were completed in the Catalyst Life Test Unit (CLTU) utilizing a liquid containing 50% Synthoil and 50% Raw Anthracene oil. This fluid has a 0.54% sulfur and 1.21% nitrogen. Two Ni-MoAl2O3 catalysts were used - Shell-324, and H-Oil. Both experiments were terminated prematurely because of equipment malfunction. Sample analyses are not yet available from these two experiments. DOE

N80-28557# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
FORMATION AND CONTROL OF FUEL-NITROGEN POLLUTANTS IN CATALYTIC COMBUSTION OF COAL-DERIVED GASES Quarterly Technical Progress Report, 15 Mar. - 15 Jun. 1979
F. V. Bracco, C. Bruno, D. A. Santavicca, J. H. Semler, and P. M. Walsh 1 Jul. 1979 53 p refs
(Contract EF-77-S-01-2762)
(FE-2762-8) Avail: NTIS HC A04/MF A01

A review was made of the available data on amounts of nitrogen containing impurities present in coal derived low and medium Btu gases. A summary was made of the most complete of the existing models for catalytic combustor operation. A summary of the theoretical and experimental work on ammonia conversion to NO sub x in catalytic combustion of low and medium-Btu gases is given in this report. Experimental investigations were made of carbon monoxide and medium Btu gas combustion in the presence of platinum supported on a monolithic Cordierite substrate. Axial profiles substrate temperature, gas temperature, and stable species concentrations were measured at different gas velocities and equivalence ratios. Computed axial and radial gas temperature and carbon monoxide concentration profiles inside a catalyst channel during carbon monoxide combustion are presented. The integrated carbon monoxide profiles at the catalyst outlet are compared with the experimentally measured values. A possible approach to minimizing ammonia to SO/sub x/ conversion in catalytic combustion of coal derived gases is presented. DOE

N80-28559# Utah Univ., Salt Lake City. Dept. of Mining, Metallurgical and Fuels Engineering.
APPLIED RESEARCH AND EVALUATION OF PROCESS CONCEPTS FOR LIQUEFACTION AND GASIFICATION OF WESTERN COALS Quarterly Progress Report, Apr. - Jun. 1979
Wendell H. Wiser Oct. 1979 88 p refs
(Contract EX-76-C-01-2006)
(FE-2006-16) Avail: NTIS HC A05/MF A01

Problems in four general areas are considered: evaluation of process concepts in relation to liquefaction and gasification of coal; catalysis studies of fundamental importance in liquefaction and gasification of coal; studies of fundamental principles involved in processes for liquefaction and gasification of coal; and properties of coal and coal conversion products, of significance in liquefaction and gasification of coal. Research highlights are: (1) A reaction pathway for hydrodeoxygenation of oxygen containing species is proposed based on studies of model compounds. Reaction pathways that can lead to coke formation and catalyst deactivation and identified; (2) Studies on the hydrodesulfurization of thiophene support the Kolbe mechanisms; and (3) Preasphaltenes produced at low conversions were characterized. The heteroatom content is similar to that of the original coal and less than that of asphaltenes and oils. The carbon aromaticity is 0.6 to 0.7, but the molecules contain only 1-2 aromatic rings per condensed ring system. DOE

N80-28559# Los Alamos Scientific Lab., N. Mex.
CADMIUM-CADMIUM CARBONATE CYCLE FOR THE THERMOCHEMICAL PRODUCTION OF HYDROGEN
C. F. V. Mason and M. G. Bowman 1980 14 p refs Presented at the 3d World Hydrogen Energy Conf., Tokyo, 23 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-579; CONF-800616-3) Avail: NTIS HC A02/MF A01

A means of thermally decomposing water using cadmium, cadmium oxide and cadmium carbonate is described. Experimental emphasis is placed on the hydrogen producing step which consists of reacting cadmium with water and carbon dioxide to produce cadmium carbonate and hydrogen. The cycle is completed by decomposing the carbonate, first to the oxide, and then to the metal. Laboratory studies show that hydrogen is evolved slowly in relatively high yields (57 to 65%), but, when produced in the presence of ammonium chloride, both the yield and rate are increased (72% in 0.5 hr). The figure of merit of the cycle is 78% with a probability of some decrease resultant from the ammonium chloride reaction. DOE

N80-28560# Brookhaven National Lab., Upton, N. Y. Dept. of Energy and Environment.
ALTERNATIVE PROCESS SCHEMES FOR COAL CONVERSION Progress Report, 1 Jun. - 31 Aug. 1979
Michael J. Sansone and Vi-Duong Dang Oct. 1979 24 p refs
(Contract EY-76-C-02-0016)
(BNL-51117; PR-3) Avail: NTIS HC A02/MF A01

To obtain pipeline grade methane, it is necessary to develop economical methods of separating methane from hydrogen and/or carbon monoxide mixtures. The hydrogen and carbon monoxide are then recycled in the process. Several separation technologies such as absorption/stripping, cryogenic, clathrate formation were examined. An absorption/stripping process calculation using propane as the absorption solvent for separation of methane from hydrogen and carbon monoxide was performed. Detailed material and energy balances for the process as well as the dimensions of the absorber and the stripper are reported. Other major pieces of equipment such as heat exchangers, pumps, and compressors were evaluated in order to determine the equivalent electrical energy of the process as approximately 13550 calle)/gm-mole methane produced. The purity of methane in the final stream is 96% by volume at 100 F and 1000 psi. The present process appears to be a potential working process for methane separation in large quantity. DOE

N80-28561# SRI International Corp., Menlo Park, Calif. Materials Research Lab.
SHIFT CONVERSION AND METHANATION IN COAL GASIFICATION: BENCH-SCALE EVALUATION OF A

SULFUR RESISTANT CATALYST Quarterly Progress Report, 1 Oct. - 31 Dec. 1979
B. J. Wood, D. Sheridan, J. G. McCarty, and H. Wise 18 Jan. 1980 16 p refs
(Contract ET-78-C-01-3240; SRI Proj. PYU-7930)
(FE-3240-T4) Avail: NTIS HC A02/MF A01

A bench-scale, long term study is in progress of the deactivation rate of a new methanation catalyst which in earlier laboratory measurements demonstrated both higher specific methanation activity and resistance to sulfur poisoning. The measurements are carried out in two parallel, fixed-bed reactors one of which contains Ir/Ni/Al2O3 and the other Ni/Al2O3. The deactivation rates were examined in terms of the loss in conversion with exposure time to the syn gas mixture, the change in temperature distribution along the axis of the catalyst bed, and the breakthrough of hydrogen sulfide in the product stream. For the same mass of catalyst and Al2O3 diluent the Ir/Ni/Al2O3 samples exhibited a considerably longer life than Ni/Al2O3. After 800 hours of operation the Ni/Al2O3 has lost nearly 99 percent of its initial activity, while the activity loss amounts to only 25 percent in the case of Ir/Ni/Al2O3. DOE

N80-28562# Sandia Labs., Albuquerque, N. Mex. Thermal Processes Div.
INSTRUMENTATION AND PROCESS CONTROL DEVELOPMENT FOR IN SITU COAL GASIFICATION Quarterly Report, Sep. - Nov. 1979
Robert E. Glass, ed. Apr. 1980 25 p refs
(Contract EY-76-C-04-0789)
(SAND-80-0482; QR-20) Avail: NTIS HC A02/MF A01

The second phase of the Hanna 4 in situ coal gasification test, Hanna 4-B, which was initiated on April 20, 1979, was completed on October 4, 1979. Sandia National Laboratories provided support by fielding and monitoring diagnostic and remote monitoring instrumentation techniques. During the final gasification stage, 765 tons of coal were reacted involving 17,000 cubic feet. The Hoe Creek 3 experiment began on August 15, 1979, and was terminated on October 10, 1979. The purpose of the experiment was to test the drilled borehole linking concept. Sandia National Laboratories' involvement consisted of fielding and monitoring both an inverted thermocouple and a surface electrical resistivity network. The inverted thermocouple was successfully tested and provided thermal data from beneath the burn zone. A real time analysis procedure for the electrical resistivity technique was implemented at Hoe Creek 3. Unfortunately, there was insufficient change in the data for this to have been a useful diagnostic. Efforts are continuing to identify the reason for this lack of response. DOE

N80-28563# Energy Resources Co., Inc., Cambridge, Mass.
FEASIBILITY OF ALTERNATIVES FOR SURFACE UTILIZATION OF COAL WASTES Final Technical Report, 29 Jul. 1979
J. Gushue Jul. 1979 287 p refs
(Contract ET-78-C-01-3105)
(FE-3105-1) Avail: NTIS HC A13/MF A01

The feasibility of using coarse coal refuse in combination with power plant fly ash to form subbase coarse material for roadway construction is evaluated for the Monogalia County region in northern West Virginia. On the basis of technical, environmental, and economic factors, it is concluded that using coal refuse/fly ash material for roadway subbase construction is feasible in the study area. The key technical and environmental considerations are related to the compaction characteristics of the material. Chemical and physical testing of the material to establish properties, in place performance, and optimum refuse/fly ash blends followed by proper mixing, handling and compaction during construction results in a strong, environmentally benign subbase course. Maximum usage of coal refuse/fly ash (3/1 ratio) on the 127 miles of new roadway planned through 1985 would utilize about 2.3 million tons of an estimated 7.5 million tons of refuse to be generated in the study area. DOE

N80-28564# Los Alamos Scientific Lab., N. Mex.
INTERFACING PRIMARY HEAT SOURCES AND CYCLES FOR THERMOCHEMICAL HYDROGEN PRODUCTION
Melvin G. Bowman 1980 11 p refs Presented at World Hydrogen Energy Conf., Tokyo, 23-26 Jun. 1980
(Contract W-7405-eng-36)
(LA-UR-80-500; CONF-800616-2) Avail: NTIS HC A02/MF A01

Advantages cited for hydrogen production from water by coupling thermochemical cycles with primary heat include the possibility of high efficiencies. These can be realized only if the cycle approximates the criteria required to match the characteristics of the heat source. Different types of cycles may be necessary for fission reactors, for fusion reactors or for solar furnaces. Very high temperature processes based on decomposition of gaseous H2O or CO2 appear impractical even for projected solar technology. Cycles based on CdO decomposition are potentially quite efficient and require isothermal heat at temperatures that may be available from solar furnaces of fusion reactors. Sulfuric acid and solid sulfate cycles are potentially useful at temperatures available from each heat source. Solid sulfate cycles offer advantages for isothermal heat sources. All cycles under development include concentration and drying steps. Novel methods for improving such operations would be beneficial. DOE

N80-28565# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
INTEGRATED SOLAR RECEIVER/BIOMASS GASIFIER RESEARCH
C. Benham, P. Bergeron, G. Bessler, and M. Bohn Nov. 1979 9 p refs Presented at the Users Assoc. Solar Fuels Workshop, Albuquerque, N. Mex. 28-29 Nov. 1979
(Contract EG-77-C-01-4042)
(SERI/TP-333-507; CONF-791143-6) Avail: NTIS HC A02/MF A01

Processes for producing liquid fuels from olefin rich pyrolysis gases obtained from fast pyrolysis of biomass are being developed. In the Diebold process the biomass, carried by steam, is blown through an entrained bed gasifier. The olefins are then separated from the rest of the reaction products and polymerized thermally to gasoline; the other gases are used as fuel for the process. The Kuester process uses a fluidized bed gasifier and a catalytic Fischer-Tropsch reactor which converts the olefins, hydrogen, and carbon monoxide into n-propanol and paraffinic hydrocarbons. The advantages over the Diebold process are shorter residence time and elimination of the gas separation requirement. One disadvantage is the low octane rating of the fuel. As part of the solar thermal program at the Solar Energy Research Institute (SERI), an entrained bed reactor/receiver for fast pyrolysis of biomass is being developed for use with either the Diebold or Kuester process. DOE

N80-28566# Chem Systems Research Center, Fairfield, N.J.
DEVELOPMENT OF ALCOHOL-BASED SYNTHETIC TRANSPORTATION FUELS FROM COAL-DERIVED SYNTHESIS GASES Quarterly Report, 14 Sep. - 14 Dec. 1979
8 Apr. 1980 68 p refs
(Contract DE-AC22-79ET-14858)
(DOE/ET-14858/T1; QR-1) Avail: NTIS HC A04/MF A01

Chem Systems is carrying out an experimental program for the conversion of coal-derived synthesis gases to a mixture of C1-C4 alcohols. The objectives are to develop a catalyst and reactor system for producing a mixture of C1-C4 alcohols, which we call Alkanol fuel, to be used as a synthetic transportation fuel and assess the technical and economic feasibility of scaling the process concept to a commercial-scale application. Some of the accomplishments made were: (1) a small (75cc) fixed-bed, plug-flow, vapor phase reaction system was set up and operated utilizing catalyst bed dilution with inert media to help limit the large exotherm associated with the synthesis gas conversion reactions; (2) a total of fifteen catalysts containing varying amounts of Cu, Co, Zn, Cr and K were prepared and seven of these catalysts were tested; (3) identification of one promising catalyst composition which has resulted in a 30% conversion of carbon monoxide per pass (synthesis gas had a 3.5 H2/CO ratio) with a carbon selectivity to alcohols of about 80%. DOE

N80-28567# Chem Systems Research Center, Fairfield, N.J.
LIQUID-PHASE METHANOL Final Report, Dec. 1979
M. Sherwin and D. Blum Dec. 1979 245 p Sponsored by Electric Power Research Inst.
(EPRI Proj. 317-2)
(EPRI-AF-1291) Avail: NTIS HC A11/MF A01

The concept of this reactor involves carrying out the synthesis of methanol in an ebullated bed of catalyst in the presence of an inert liquid heat carrier. Work was carried out on laboratory, continuous bench-scale, and a process development unit. DOE

N80-28568# Sandia Labs., Albuquerque, N. Mex. Explosives Testing Organization 1533.
PRELIMINARY EXPERIMENTS USING LIGHT-INITIATED HIGH EXPLOSIVE FOR DRIVING THIN FLYER PLATES
R. A. Benham Feb. 1980 36 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1847) Avail: NTIS HC A03/MF A01

Light-initated high explosive silver acetylide - silver-nitrate (SASN) was used produce simulated X-ray blow-off impulse loading on reentry vehicles to study the system structural response. SASN can be used to accelerate thin flyer plates to high terminal velocities which in turn, can deliver a pressure pulse that can be tailored to the target material. This process is important for impulse tests where both structural and material response is desired. The theories used to calculate the dynamic state of the flyer plate prior to impact are summarized. Data from several experiments are presented which indicate that thin flyer plates can be properly accelerated and that there are predictive techniques available which are adequate to calculate the motion of the flyer plate. Recommendations are made for future study that must be undertaken to make the SASN flyer plate techniques usable. DOE

N80-28569# Midwest Research Inst., Golden, Colo.
CONVERSION SYSTEM OVERVIEW ASSESSMENT. VOLUME 3: SOLAR THERMAL/COAL OR BIOMASS DERIVED FUELS
R. J. Copeland Feb. 1980 33 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-35-078-Vol-3) Avail: NTIS HC A03/MF A01

The conversion of synthetic fuels with solar thermal heat is discussed. The method is a hybrid combination of solar energy with either coal or biomass. A preliminary assessment of this technology is made by calculating the cost of fuel produced as a function of the cost of coal and biomass. It is shown that within the projected ranges of coal, biomass, and solar thermal costs, there are conditions when solar synthetic fuels with solar thermal heat will become cost competitive. DOE

N80-28570# Energy and Environmental Analysis, Inc., Arlington, Va.
TECHNICAL AND ECONOMIC FEASIBILITY OF ALTERNATIVE FUEL USE IN PROCESS HEATERS AND SMALL BOILERS
Feb. 1980 300 p
(Contract DE-AC01-79EI-10547)
(DOE/EIA-10547/01) Avail: NTIS HC A14/MF A01

The technical and economic feasibility of using fuels other than oil and natural gas in combustors not regulated by the Powerplant and Industrial Fuel Use Act of 1978 (FUA) was evaluated. The impact of several measures to encourage the substitution of alternative fuels in these combustors was analyzed. The primary processes in which significant fuel savings can be achieved were identified. The combustors evaluated comprise approximately 45% of the fuel demand projected in 1990. These uses would account for more than 3.5 million barrels per day equivalent fuel demand in 1990. DOE

N80-28571# Department of Energy, Washington, D. C. Office of Transportation Programs.
ALTERNATIVE FUELS, FUEL ADDITIVES AND RELATED DEVICES FOR HIGHWAY VEHICLES: R, D AND D PROPOSAL GUIDELINES
Apr. 1980 25 p
(DOE/CS-0154) Avail: NTIS HC A02/MF A01

A technology is described which will help decrease U.S. dependence on and eventually replace petroleum as a major fuel resource. Alternative fuels, fuel additives, and engine/vehicle hardware that relate specifically to alternative fuel(s) handling and management are emphasized. Test data requirements for alternative fuels, fuel additives, extenders, and alternative fuel and related devices and systems are presented. A summary of submission requirements is also included. DOE

N80-28572# New Zealand Energy Research and Development Committee, Auckland.
THE POTENTIAL OF ENERGY FARMING FOR TRANSPORT FUELS IN NEW ZEALAND
G. S. Harris, M. L. Leamy, T. Fraser, J. B. Dent, W. A. N. Brown, W. B. Earl, and T. W. Fookes Aug. 1979 130 p refs
Prepared in cooperation with Dept. of Scientific and Industrial Research, New Zealand and Soil Bureau, Forest Research Inst., Lincoln Coll., Canterbury Univ., and Waikato Univ.
(PB80-154248; Rept-46) Avail: NTIS HC A07/MF A01 CSCL 21D

The main economic aspects or energy farming are discussed. A set of guidelines are considered along which it is believed energy farming should or could be developed. Environmental and social factors associated with energy farming implementation are also considered. GRA

N80-28573# New Zealand Energy Research and Development Committee, Auckland.
THE POTENTIAL OF ENERGY FARMING FOR TRANSPORT FUELS IN NEW ZEALAND, APPENDICES
G. S. Harris, M. L. Leamy, T. Fraser, J. B. Dent, W. A. N. Brown, W. B. Earl, T. W. Fookes, and J. Gilbert Aug. 1979 134 p refs Prepared in cooperation with Dept. of Scientific and Industrial Res., New Zealand, Soil Bureau, Forest Res. Inst., Lincoln Coll., Canterbury Univ., and Waikato Univ.
(PB80-154255; Rept-46-App) Avail: NTIS HC A07/MF A01 CSCL 21D

The inventory of land suitable for the growth of crops necessary for biomass energy production is considered. Suitability prescriptions for mapping the distribution of resources needed for this process are presented. R.C.T.

N80-28574# Office of Technology Assessment, Washington, D. C.
ALTERNATIVE ENERGY FUTURES. PART 1: THE FUTURE OF LIQUEFIED NATURAL GAS IMPORTS
Mar. 1980 133 p
(PB80-173552; OTA-E-110) Avail: NTIS HC A07/MF A01 CSCL 21D

Worldwide availability of natural gas for U.S. import as liquefied natural gas is discussed with respect to projected U.S. gas demand, alternative North American oil and gas resources, and the security of foreign supplies. Sections on LNG project structure, cost, and financing are included. Observations about balance of payment impacts and public exposure to financial risk are also reported. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-28575# Societe Nationale Industrielle Aerospatiale, Paris (France). Dept. Analyse de la Valeur.
VALUE ANALYSIS AND OPTIMUM COST DESIGN PRINCIPLES APPLIED BY SNIAS [L'ANALYSE DE LA VALEUR ET LE PRINCIPE CONCEPTION POUR UN COUT OPTIMUM (C.C.O.) APPLIQUEE A L'AEROSPATIALE]
Robert Tassinari 1979 16 p In FRENCH Presented at 1st Congr. Natl. pour l'Anal. de la Valeur, Paris, 29-30 Mar. 1979
(SNIAS-792-501-104) Avail: NTIS HC A02/MF A01

The optimum cost method derived from the United States design-to-cost considerations was successfully exploited by the SNIAS. This method is based on training personnel to perform the necessary analysis. A group leader is given the responsibility of: (1) establishing performance, costs and delivery times; (2) evaluating the financial bases of the program (above all the life cycle and production costs); (3) breaking down the work into different tasks together with associated costs; and (4) organizing operational groups to study the different tasks and their implementation. Specific examples are given.
Author (ESA)

N80-28576# Research Inst. of National Defence, Stockholm (Sweden).

SIMULATED ACCIDENTS IN THE HANDLING OF PHOSGENE AT KENOGARD AIR BASE, SWEDEN [MODELLHAVERIER VID FOSGENHANTERING VID KENOGARD AB I SUNDSVALL]

Gunnel Dreborg, Lars Frankenberg, Edvard Karlsson, and Kenneth Nyren Dec. 1979 42 p refs In SWEDISH
(FOA-A-40030-C1) Avail: NTIS HC A03/MF A01

Scenarios were prepared for activities following a leak in a phosgene processing facility. Diffusion and toxicity levels were compared for various distances for two cases. The influence of weather conditions on the severity of an accident was considered. It is concluded that an accident involving phosgene would be no worse than one involving chlorine. Author (ESA)

N80-28577# Earthquake Engineering Research Inst., Berkeley, Calif.

OPTIMAL DESIGN OF LOCALIZED NONLINEAR SYSTEMS WITH DUAL PERFORMANCE CRITERIA UNDER EARTHQUAKE EXCITATIONS

M. A. Bhatti Jul. 1979 110 p refs
(Grant NSF ENV-76-04264)
(PB80-167109; UCB/EERC-79/15; NSF/RA-790395) Avail: NTIS HC A06/MF A01 CSCL 13M

A formulation is presented for earthquake resistant design of localized nonlinear systems. Based upon the current design criteria, two levels of performance constraints are imposed as follows. For small earthquakes which occur frequently, the structure is constrained to remain elastic with no structural damage. For a large earthquake, the structure can undergo inelastic deformations at known locations of nonlinearities, with limited damage. The problem is formulated as a min-max problem, and a general strategy to transcribe it to the canonical form of a nonlinear programming problem is given. An algorithm of the feasible directions type is given to solve the resulting nonlinear programming problem. The general techniques are applied to the design of nonlinear energy-absorbing devices, which are part of an earthquake isolation system for many types of buildings. Several design problems with different performance criteria are considered and the results compared to see the effect of these different criteria. Comparison is also made with results reported earlier with only one level of constraints. The results clearly show the effectiveness of the present approach with dual performance criteria over the conventional single criterion approach. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-28578* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SCANNABLE BEAM FORMING INTERFEROMETER ANTENNA ARRAY SYSTEM Patent

Julius A. Kaiser, Jr., inventor (to NASA) Issued 15 Jul. 1980 6 p Filed 14 May 1979 Supersedes N79-26252 (17 - 17, p 2249)
(NASA-Case-GSC-12365-1; US-Patent-4,213,131; US-Patent-Appl-SN-039031; US-Patent-Class-343-844; US-Patent-Class-343-100SA; US-Patent-Class-343-854) Avail: US Patent and Trademark Office CSCL 20N

An antenna array is described which comprises three interferometer pairs of antenna elements with selected spacings made to form a single beam which is readily scannable. All spatial frequencies generated by a signal and intercepted by the array are derived from a signal processing technique applied to the array. The array samples space in the spatial frequency domain while the signal processing technique utilizes real time convolution of functions in the spectral frequency domain. Summation of the appropriate spatial frequencies is equivalent to a Fourier transform operation, yielding the location of the signal source in space. Resolution and freedom from interference of the interferometer system is equal to that of a fully filled array of the same aperture size containing element spacings of one half wavelength. An antenna array system comprising four antenna elements forming six interferometer pairs with a resolution equal to that of a sixteen element array with spacings of one half wavelength is described, as well as other multiples of one quarter wavelength of partial multiples of a wave length.

Official Gazette of the U.S. Patent and Trademark Office

N80-28579 City Univ. of New York, N. Y.

DELTA MODULATION SYSTEMS FOR VOICE COMMUNICATION Ph.D. Thesis

Vaman Rao Dhadesugoor 1980 165 p
Avail: Univ. Microfilms Order No. 8014963

The performance of the Song Voice Adaptive Delta Modulator (SVADM) and the Continuously Variable Slope Delta Modulator (CVSD) in terms of dynamic range, sampling rate and channel errors are compared. The use of SVADM and CVSD as source encoders in packet voice networks, the digital silence detection algorithm and the performance of the network are presented. The performance of the network was evaluated subjectively for both the fixed packet size scheme as well as the variable packet size scheme. The parameters employed for subjective evaluation are packet size, silence detection algorithm, bit rate and packet loss rate. In addition, a new concept of variable rate delta modulator is presented. Dissert. Abstr.

N80-28580 Johns Hopkins Univ., Baltimore, Md.

ADAPTIVE NOISE FEEDBACK CODING OF SPEECH IN SYSTEMS WITH NONADAPTIVE PREDICTORS Ph.D. Thesis

Richard Paul Bastian 1980 125 p
Avail: Univ. Microfilms Order No. 8014258

Two solutions for the adaptive feedback filter evolve from minimizing a frequency weighted output noise-to-signal ratio, one quite general and the other from assuming white quantizing noise. The general solution suggests a sequential adaptation, and subsequently a sequential lattice filter is used in simulations because it guarantees stability. The white noise solution is used to predict the theoretical variation of the signal to noise ratio with the amount of noise shaping. Computer simulations show good agreement with the theoretical model. Most importantly, both solutions exhibit subjective improvements over (DPCM) coders, which are special cases of adaptive noise feedback coders. Hence DPCM coders can be improved, without increasing the bit rate, by using adaptive feedback filters. The simulations also show these improvements depend on the number of quantizer levels. Dissert. Abstr.

N80-28581# Indian Space Research Organization, Ahmedabad. Space Applications Center.

SATELLITE INSTRUCTIONAL TELEVISION EXPERIMENT. TELEVISION COMES TO VILLAGE: AN EVALUATION OF SITE

Binod C. Agrawal Bangalore, India Oct. 1978 107 p refs (ISRO-SAC-TR-09-78) Avail: NTIS HC A06/MF A01

The design and conclusions of India's satellite instructional television experiment (SITE) are presented and discussed. The socio-cultural changes triggered by the introduction of satellite TV were the central interest of the investigation. Seven villages, one each from six clusters and Kheda, about 20 to 30 km away from an urban centre and least contaminated by urban influence were selected. The field work was divided into three phases: pre-SITE, during-SITE, and post-SITE. Anthropological field methods were the main tools of data collection. The data were analyzed at two levels; household and village. Instructional, recreational, and children's programs were broadcast. Results indicate that, due to TV exposure, a number of innovations were adopted. Also, viewers' attendance was found to be intimately linked to agricultural and religious activity cycles of the village. The major implications which can be drawn to provide planning inputs for future national satellite based TV systems are summarized addressing problems in program type, schedules, and language differences. M.G.

N80-28582*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

BEAMED MICROWAVE POWER TRANSMITTING AND RECEIVING SUBSYSTEMS RADIATION CHARACTERISTICS

Richard M. Dickinson 15 Jun. 1980 77 p refs
(Contract NAS7-100)
(NASA-CR-163362; JPL-Pub-80-11) Avail: NTIS HC A05/MF A01 CSCL 20N

Measured characteristics of the spectrum of typical converters and the distribution of radiated Radio Frequency (RF) energy from the terminals (transmitting antenna and rectenna) of a beamed microwave power subsystem are presented for small transmitting and receiving S-band (2.45 GHz) subarrays. Noise and harmonic levels of tube and solid-state RF power amplifiers are shown. The RF patterns and envelope of a 64 element slotted waveguide antenna are given for the fundamental frequency and harmonics through the fifth. Reflected fundmanetal and harmonic patterns through the fourth for a 42 element rectenna subarray are presented for various dc load and illumination conditions. Bandwidth measurements for the waveguide antenna and rectenna are shown. Author

N80-28583*# Axiomatix, Los Angeles, Calif.
SHUTTLE ORBITER KU-BAND RADAR/COMMUNICATIONS SYSTEM DESIGN EVALUATION. DELIVERABLE TEST EQUIPMENT EVALUATION Interim Report
Robert G. Maronde 31 Jul. 1980 32 p
(Contract NAS9-15795)
(NASA-CR-160761; R8007-5) Avail: NTIS HC A03/MF A01 CSCL 17B

The Ku-band test equipment, known as the Deliverable System Test equipment (DSTE), is reviewed and evaluated. The DSTE is semiautomated and computer programs were generated for 14 communication mode tests and 17 radar mode tests. The 31 test modules provide a good cross section of tests with which to exercise the Ku-band system; however, it is very limited when being used to verify Ku-band system performance. More detailed test descriptions are needed, and a major area of concern is the DSTE sell-off procedure which is inadequate. L.F.M.

N80-28584# Morgenthaler (Frederick R.), Wellesley, Mass.
THEORETICAL STUDIES OF MICROSTRIP ANTENNAS. VOLUME 1: GENERAL DESIGN TECHNIQUES AND ANALYSES OF SINGLE AND COUPLED ELEMENTS Final Report, Apr. 1978 - Jul. 1979
Frederick M. Morgenthaler Sep. 1979 61 p refs 2 Vol.
(Contract DOT-TSC-15364)
(AD-A075480; FAA-EM-79-11-1-Vol-1; DOT-TSC-FAA-79-21-Vol-1) Avail: NTIS HC A04/MF A01 CSCL 09/5

Volume 1 of Theoretical Studies of Microstrip Antennas deals with general design techniques and analyses of single and coupled radiating elements. Specifically, we review and then employ an important equivalence theorem that allows a pair of vector potentials, A-bar and A-bar-star to be calculated from fields tangential to any surface enclosing all currents and charges. These potentials serve to calculate the far fields, from which radiation conductance and pattern can be obtained. For rectangular microstrip patch antennas, we develop novel approximations so as to include the effects of currents induced on the ground planes by fringing fields. Coupling between two patches sharing the same substrate and ground plane, or else employing separate ones stacked one above the other, is also considered by means of a novel approximation that helps provide physical insight with respect to field patterns, coupling between patches and the like. As an important by product of this work, several new approxiamte formulas are obtained that very accurately predict the electrical characteristics of microstrip transmission lines of arbitrary width and substrate thickness when the dielectric constant of the substrate is also arbitrary. Volume 2 of this report is devoted to the analysis and synthesis of multiresonant elements with emphasis on dual frequency operation of rectangular microstrip patch antennas with or without external matching networks. GRA

N80-28585# Boston Coll., Chestnut Hill, Mass. Space Data Analysis Lab.
E AND F LAYER H.F. VOLUME BACKSCATTER REFLECTIVITIES Final Technical Report, 15 Dec. 1977 - 31 Dec. 1979
Edward N. Richards and William C. McComish Feb. 1980 42 p refs
(Contract F19628-78-C-0036; AF Proj. 2305)
(AD-A084835; BC-SDAL-79-2; RADC-TR-80-25) Avail: NTIS HC A03/MF A01 CSCL 17/9

H.F. radar backscatter data from an OTH radar site in northern Maine have been processed to produce estimates of E and F layer volume backscatter reflectivities. Nighttime returns were selected from the months of September and October and were sorted into evening and midnight time segments for active and quiet days. The reflectivities were analyzed for dependence on geomagnetic coordinates, as well as for dependence on frequency and auroral conditions. The frequency dependence through the 8-19 MHz range was very strong, while no clear geomagnetic correlation could be established. GRA

N80-28586# New Mexico State Univ., Las Cruces. Physical Science Lab.
ANALYSIS OF MONOPULSE TRACKER ANTENNA PERFORMANCE IN A MULTIPATH ENVIRONMENT
K. R. Carver and T. F. Bush Apr. 1980 99 p refs
(Contract DAAD07-79-C-0008; DA Proj. 1L1-62111-AH-71)
(AD-A085131; ERADCOM/ASL-CR-80-0008-2; USD-1366)
Avail: NTIS HC A05/MF A01 CSCL 17/9

This report summarizes the results of a study of monopulse tracking antenna performance at low angles. The objectives of this study were two-fold: (1) to investigate the multipath effects of surface roughness and soil moisture on the elevation accuracy of a monopulse tracker, particularly at low angles. This includes the antenna beam shape characteristics such as beamwidth, roll-off rate and sidelobe level; and (2) to determine which, if any, realizable antenna designs might yield a significant improvement in tracking accuracy down to about 5 deg, keeping in mind logistics requirements for a light weight portable antenna. Although this study did not initially constrain itself to previous practical antenna sizes such as the GMD, PLUSS, etc., it was recognized that the optimum antenna selected would need to eventually consider size and weight factors. Therefore the previously measured performance characteristics of the GMD and PLUSS antennas were reviewed and included in a comparative performance evaluation. There are two basic findings presented herein: (1) in order to track in elevation down to 5 deg, a sum-pattern 3 dB beam-width of 5 deg and a -40 dB sidelobe level is required; and (2) this performance can be best obtained from a microstrip antenna array using graphite-epoxy struss technology. GRA

N80-28587# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
THE POLARIZABILITIES OF APERTURES OF ARBITRARY SHAPE
Ephraim E. Okon and Roger F. Harrington Mar. 1980 117 p refs
(Contract N00014-76-C-0225)
(AD-A084832; TR-80-2; TR-12) Avail: NTIS HC A06/MF A01 CSCL 20/3

The integral equations for the electric and magnetic polarizabilities of small apertures of arbitrary shape in a conducting screen are solved by the method of moments. Solutions are obtained by a subdomain method using the Gordon-Hall and Zienkiewicz-Phillips subdivision techniques. The method is illustrated by application to apertures of many shapes, such as circles, squares, semicircles, triangles, annular sectors, circle with tangents, hexagons, and ellipses. GRA

N80-28588# Air Force Geophysics Lab., Hanscom AFB, Mass. Space Physics Div.
MAGNETIC DISTURBANCE STATISTICS FROM A SINGLE STATION Q INDEX APPLIED TO AN ACTUAL OTH-B RADAR SITUATION Environmental Research Papers
B. S. Dandekar 18 Dec. 1979 41 p refs
(AF Proj. 4643)
(AD-A084808; AFGL-TR-79-0296; AFGL-ERP-687) Avail: NTIS HC A03/MF A01 CSCL 17/9

Due to the systematic diurnal motion of the auroral oval, the Q values of magnetic activity derived from a single station are not directly usable to determine the expected degree of auroral activity. To remove the diurnal effects from a single station

data base, which leads in daytime to an under estimation of the Q index, an empirical set of detrending factors was determined for the Sodankyla Q data base. These factors show that the probability that a given level of magnetic activity will be exceeded for a given duration is underestimated by up to a factor of 2 in the least sensitive daytime sector. The detrended data base has been analyzed to determine the probability that a given Q value is exceeded for a selected duration. This analysis has been done for durations up to 12 hr separately for the night and daytime detrended data bases. The results are very similar and confirm that the detrending has been successfully accomplished. Finally the individual and cumulative probabilities that a given Q is exceeded for a selected duration (periods from 0.25 to 24 hr) have been established for the fully detrended data base. To interpret the results in their effect on the Over-the-Horizon Experimental Radar System, the distribution of probabilities has been modulated with the dynamics of the auroral oval by use of the Starkov equation (1969). This permits the assessments of the probability that a fixed location in the radar coverage area is under the auroral oval. GRA

N80-28588# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PROPERTIES OF THE LINEAR POLARIZATION BISTATIC SCATTERING MATRIX
Gregory E. Heath 10 Mar. 1980 18 p refs
(Contract F19628-80-C-0002)
(AD-A085054; TN-1980-7; ESD-TR-79-336) Avail: NTIS HC A02/MF A01 CSCL 17/9

When the plane containing the transmitter and receiver lines of sight is used as the polarization reference plane, the scattering matrix characterizing linearly polarized bistatic scattering from plane-symmetric targets exhibits scattering geometry symmetries which can be exploited to reduce the time and expense in obtaining bistatic scattering data from static range measurements and theoretical or computer calculations. In this report the linear polarization symmetry relations are derived and used to determine the minimum number of measurements needed for the complete characterization of target scattering. GRA

N80-28590# Harry Diamond Labs., Adelphi, Md.
USE OF A PARALLEL PLATE TRANSMISSION LINE TO CALIBRATE A FIBER-OPTIC COUPLED MAGNETIC FILED SENSOR
Andrew A. Cuneo, Jr. and James L. Lofius Jan. 1980 17 p refs Sponsored by Army Material Development and Readiness Command
(AD-A085201; HDL-TM-80-11) Avail: NTIS HC A02/MF A01 CSCL 17/6

It is vitally important to accurately measure the field components of a simulated electromagnetic pulse (EMP), to determine both the waveshape and the amplitude of the electromagnetic test environment. A parallel plate transmission line is used to calibrate a magnetic field sensor as well as to determine the field enhancement factor when the sensor is mounted on the compact transmitter of an optical electronic data-link system. The transmitter is coupled to the recording instrumentation by means of a fiber-optic cable rather than an RF cable, thus eliminating a spurious signal pickup source. Some comments are also made on the use of enhancement factors for magnetic field sensors mounted on cubical boxes. GRA

N80-28591# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical Engineering.
INTEGRATED OPTIC SIGNAL PROCESSORS FOR WIDEBAND RADAR SYSTEMS Technical Report, 15 Jul. 1978 - 30 Jan. 1980
Chen S. Tsai May 1980 36 p refs
(Contract DASG60-78-C-0122)
(AD-A085008; ATR-2) Avail: NTIS HC A03/MF A01 CSCL 17/9

The general objective of this research is to explore the potential of integrated acoustooptic (AO) technology with application to wideband radar systems. The potential of AO devices for real-time processing of wideband radar signals has been well recognized. Accordingly, implementation of AO signal processors using integrated optic techniques constitutes one of the most important on-going R and D activities. The major objectives of this research are to carry out research on integrated acoustooptic signal processing including pulse compression, convolution, and correlation. Thus specific tasks of the research are: (1) to further explore guided-wave AO pulse compressors and convolvers, and (2) to initiated research on guided-wave AO correlators. GRA

N80-28592# Naval Underwater Systems Center, New London, Conn. Surface Ship Sonar Systems Dept.
SOME WINDOWS WITH VERY GOOD SIDELOBE BEHAVIOR: APPLICATION TO DISCRETE HILBERT TRANSFORM
Albert H. Nuttall 9 Apr. 1980 39 p
(ZR0000101)
(AD-A085032; NUSC-TR-6239) Avail: NTIS HC A03/MF A01 CSCL 17/9

Some of the windows presented by Harris -- Proc. IEE, Jan. 78 -- are not correct in terms of their reported peak sidelobes and optimal behavior. We present corrected plots of Harris' windows and also derive additional windows with very good sidelobes and optimal behavior under several different constraints. These plots enable the reader to select a window to suit his requirements, in terms of bias due to near-by sidelobes and bias due to distant sidelobes. An application of the new windows to a technique for calculating the discrete Hilbert transform is presented. GRA

N80-28593# Army Missile Command, Redstone Arsenal, Ala. Technology Lab.
A MATHEMATICAL ANALYSIS OF POLARIMETRIC PHASE AND AMPLITUDE WITH FREQUENCY AGILITY FOR RADAR TARGET ACQUISITION
P. Martin Alexander 24 Sep. 1979 44 p refs
(AD-A084857; DRSMI-T-79-92) Avail: NTIS HC A03/MF A01 CSCL 17/9

Target models have been used to generate a mathematical analysis of the output voltage from a frequency agile radar with polarimetric processing. The purpose of the investigation was to determine the usefulness of such a system for target acquisition. It is shown that frequency agility provides a frequency spectrum at the output which is characteristic of the major reflecting centers illuminated by the radar. Polarimetric processing is not required to obtain this information. It is shown that each pair of individual reflectors contributes a frequency to the Fourier transformed signal. For a linearly frequency modulated waveform, this frequency depends on the difference in radar range between the two reflectors, the bandwidth of the transmitter, and the repetition period of the LFM waveform. GRA

N80-28594# Analysis and Technology, Inc., North Stonington, Conn.
ANALYSIS OF SIDE-LOOKING AIRBORNE RADAR PERFORMANCE IN THE DETECTION OF SEARCH AND RESCUE TARGETS Interim Report, Jan. 1978 - Mar. 1980
N. C. Edwards, Jr., T. J. Mazour, G. L. Hover, and S. R. Osmer Mar. 1980 100 p refs
(Contract DOT-CG-81-79-2038)
(AD-A085182; USCG-D-31-80; CGR/DC-2/80) Avail: NTIS HC A05/MF A01 CSCL 17/9

Since September 1978 side-looking airborne radar (SLAR) detection data has been gathered in conjunction with visual detection experiments conducted by the U.S.C.G. R D Center. These are the first in a series of experiments designed to improve search planning guidance contained in the National Search and Rescue Manual. HC-130 aircraft, equipped with either the Airborne Oil Surveillance System (AOSS) or SLAR/radar image processor (SLAR/RIP) configuration of the AN/APS-94D SLAR, conducted controlled searches for life rafts, small boats, and 41 to 95 foot Coast Guard vessels in Block Island Sound or open ocean. Through the use of a microwave ranging system and SLAR data, the positions of searchers and targets were accurately reconstructed to facilitate the verification of detections on SLAR films or video tape. These data were used to evaluate the effects of environmental and controllable parameters on SLAR detection of the various target types. While the size of the data base did not permit conclusive, quantitative assessment of the effect which each parameter had on SLAR detection performance, general trends, in system performance were identified. Of the 11 parameters which were investigated, preliminary indications are that wind speed, image background, sea state, precipitation,

altitude, antenna polarization, target size/composition, and lateral range all may significantly influence SLAR detection of search and rescue targets. Further data collection and analysis is planned to quantify the effects of these and any other significant parameters on SLAR performance. GRA

N80-28595# Auburn Univ., Ala. Engineering Experiment Station.

INVESTIGATION OF COMPLEX ANGLE PROCESSING TO REDUCE INDUCED ANGLE POINTING ERRORS Final Technical Report, 10 Dec. 1976 - 15 Sep. 1978

David G. Burks and Edward Graf 1 Oct. 1979 208 p refs (Contract DAAK40-77-C-0022)

(AD-A085263; AN-EE-0022) Avail: NTIS HC A10/MF A01 CSCL 17/9

This work is an analysis of the effect of a tangent ogive radome on the pointing accuracy of a monopulse radar that employs an aperture antenna. The incident fields at the antenna are found by a ray tracing procedure. The theory of monopulse radar and the transmission and reflection properties of planar dielectric slabs are presented. Two orthogonal polarization states which can be combined to produce an arbitrarily polarized incident field are considered. The antenna can be scanned in two angular directions and radar pointing error is presented for both these angles as a function of antenna scan angle and polarization of the incident field. A method that can be used to compensate for radome induced error is presented. Complex angle processing for the purpose of pointing angle reduction was investigated. GRA

N80-28596# Naval Postgraduate School, Monterey, Calif.

RADIO FREQUENCY SPECTRUM MANAGEMENT M.S. Thesis

Edward Joseph Sujdak, Jr. Mar. 1980 129 p refs

(AD-A085063) Avail: NTIS HC A07/MF A01 CSCL 17/2

This thesis is a study of radio frequency spectrum management as practiced by agencies and departments of the Federal Government. After a brief introduction to the international agency involved in radio frequency spectrum management, the author concentrates on Federal agencies engaged in frequency management. These agencies include the National Telecommunications and Information Administration (NTIA), the Interdepartment Radio Advisory Committee (IRAC), and the Department of Defense (DoD). Based on an analysis of Department of Defense frequency assignment procedures, recommendations are given concerning decentralizing military frequency assignment by delegating broader authority to unified commanders. This proposal includes a recommendation to colocate the individual Service frequency management offices at the Washington level. This would result in reduced travel costs, lower manpower requirements, and a common tri-Service frequency management data base. GRA

N80-28597# Hughes Research Labs., Malibu, Calif.

INTELLIGENT BANDWITH COMPRESSION Final Report, 1 Nov. 1978 - 31 Jul. 1979

D. Y. Tseng, B. L. Bullock, K. E. Olin, R. K. Kandt, and J. D. Olsen (Hughes Aircraft Co., Fullerton, Calif.) Feb. 1980 115 p refs

(Contract DAAK70-78-C-0148)

(AD-A085184) Avail: NTIS HC A06/MF A01 CSCL 17/2

The feasibility of a 1000:1 bandwidth compression ratio for image transmission has been demonstrated using image-analysis algorithms and a rule-based controller. Such a high compression ratio was achieved by first analyzing scene content using auto-cueing and feature-extraction algorithms, and then transmitting only the pertinent information consistent with mission requirements. A rule-based controller directs the flow of analysis and performs priority allocations on the extracted scene content. The reconstructed bandwidth-compressed image consists of an edge map of the scene background, with primary and secondary target windows embedded in the edge map. The bandwidth-compressed images are updated at a basic rate of 1 frame per second, with the high-priority target window updated at 7.5 frames per second. The scene-analysis algorithms used in this system together with the adaptive priority controller are described. Results of simulated 1000:1 band width-compressed images are presented. A video tape simulation of the Intelligent Bandwidth Compression system has been produced using a sequence of video input from the data base. GRA

N80-28598# California Univ., San Diego, La Jolla. Dept. of Electrical Engineering and Computer Science.

A SIMPLIFIED THEORY OF ELF PROPAGATION IN ITS EARTH-IONOSPHERE TRANSMISSION LINE AND ITS WORLDWIDE APPLICATION, SUPPLEMENT

Henry G. Booker 1980 14 p refs

(Contract N00014-78-C-0682)

(AD-A085208) Avail: NTIS HC A02/MF A01 CSCL 20/14

The NOSC computer program has confirmed that non-reciprocity in the ELF band is not introduced in the refracting stratum near the bottom of the ionosphere. It is introduced higher up where the direction of phase propagation is almost vertical. It has been determined that the effect of a slightly off-vertical angle for the direction of phase propagation in the ionosphere in the ELF band does in fact cause the non-reciprocity obtained by Pappert and Moler (1974). The electromagnetic reason for this has been identified and is described below. The fact that off-vertical angles of less than a degree for the direction of phase propagation have noticeable effects raises the question of how precisely the stratification of the ionosphere may be assumed to be horizontal. GRA

N80-28599# TRW Defense and Space Systems Group, Redondo Beach, Calif.

CHARGE COUPLED DEVICES IN SIGNAL PROCESSING SYSTEMS, VOLUME 5 Final Report, Oct. 1973 - Dec. 1979

P. A. Allen, J. M. Anderson, F. G. Hamilton, W. H. Huber, M. Penberg, T. A. Zimmerman, R. Nicas, and N. Schneier Dec. 1979 313 p refs

(Contract N00014-74-C-0068)

(AD-A084829) Avail: NTIS HC A14/MF A01 CSCL 09/1

This report provides a comprehensive treatment of the entire digital charge coupled device (DCCD) program. The design history, starting from SSI logic circuits and continuing through MSI and LSI multipliers and adders, is discussed. The process development is traced from the early metal gate P-channel process to the final double poly n-channel process. Results of radiation testing on DCCD circuits is presented. Several computer aided design techniques are described which were developed during the course of the program. Finally, other programs related to and resulting from this effort are described. GRA

N80-28600# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.

A MAXIMAL FLOW APPROACH TO DYNAMIC ROUTING IN COMMUNICATION NETWORKS

Mario Jodorkovsky and Adrian Segall May 1980 120 p refs (Contracts N00014-75-C-1183; N00014-77-C-0532)

(AD-A085160; LIDS-R-988) Avail: NTIS HC A06/MF A01 CSCL 17/2

This work presents a new approach for building the feedback solution for the minimum delay dynamic message routing problem for single destination networks. The approach fully exploits the special structure of the constraint matrices obtained in the dynamic state space model suggested in previous works, by transforming every linear program arising from the necessary conditions, into a maximal weighted flow problem. Taking advantage of several properties concerning the networks corresponding to the linear programming problems, all theorems regarding certain simplifying characteristics of the feedback solution that apply in the case of single destination networks with all unity weightings in the cost functional are reproved in a simplified and more straightforward manner. A compact algorithm for the construction of the feedback solution is presented, the algorithm being implementable on networks of reasonable size. A method for obtaining all solutions of the linear programming problems required by the algorithm, based on the application of linear programming techniques in networks is provided. The method is implemented by a computer program and several examples are run to test its applicability. GRA

N80-28601# Naval Postgraduate School, Monterey, Calif.

PERFORMANCE OF A DIGITAL DATA TRANSMISSION SYSTEM USING MATCHED FILTER PROCESSING OF AN

AUXILIARY SIGNAL FOR SYNCHRONIZATION M.S. Thesis
Serdar Yurdakul and Sedat Sentürk Dec. 1979 64 p refs
(AD-A085152) Avail: NTIS HC A04/MF A01 CSCL 17/2

In digital communication, coherent systems are used in order to provide small probability of error with small signal-to-noise ratios. In this report a digital communication system (transmitter and receiver) is presented which uses noncoherent carrier demodulation and coherent bit recovery utilizing an integrate-and-dump detector. The synchronization (timing) pulses for this detector are derived from the response of a matched filter to the low level synchronization signal transmitted with high level data modulated carrier. This system is designed, built and tested; noise is added to simulate the channel. Probability of error versus signal-to-noise ratio curves are plotted to obtain system performance. GRA

N80-28602# Naval Postgraduate School, Monterey, Calif.
A STUDY OF THE COMMUNICATION CAPABILITIES OF THE OPARS FLIGHT PLANNING SYSTEM FOR VARIOUS LEVELS OF DEMAND M.S. Thesis
Kenneth L. Smith Mar. 1980 53 p refs
(AD-A084902) Avail: NTIS HC A04/MF A01 CSCL 17/2

Through the Optimum Path Aircraft Routing System (OPARS) Fleet Numerical Oceanography Center (FNOC) has committed itself to providing a computerized flight planning service remotely accessible via dial-up communications lines. The question arises as to whether the proposed number of telephone lines will be adequate to provide a level of service previously provided by the Lockheed Jetplane system. This study provides a detailed analysis of the response delays for the OPARS flight plan system. In addition, estimates are given of communication requirements when various levels of demand prevail, and under conditions in which the FNOC computer is busy or idle. GRA

N80-28603# Atlantic Research Corp., Alexandria, Va.
COMMUNICATIONS-ELECTRONIC INTRASYSTEM ELECTROMAGNETIC INTERFERENCE MEASUREMENT TECHNIQUES AND INSTRUMENTATION Quarterly Report, 21 Dec. 1979 - 20 Mar. 1980
Lester E. Polisky and John Savage May 1980 72 p refs
(Contract DAAK80-79-C-0786)
(AD-A085161; CORADCOM-79-0786-3; QR-3) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report presents the results obtained during the third quarter of the Communications-Electronics Intrasystem Electromagnetic Interference Measurement Techniques and Instrumentation Project. The period covered was 21 Dec. 1979 to 20 March 1980. The major effort in the third quarter consisted of completing the broadband measurement technique description and initiating the evaluation of MIL-STD-461A techniques. GRA

N80-28604# Mississippi Univ., University. Dept. of Electrical Engineering.
ANTENNA ANALYSES: OBJECTS NEAR ANTENNAS AND MICROSTRIP ANTENNAS Final Report, Jun. 1976 - Dec. 1979
Chalmers M. Butler Feb. 1980 10 p refs
(Grant DAAG29-76-G-0285)
(AD-A084843; ARO-14107.7-ELX) Avail: NTIS HC A02/MF A01 CSCL 09/5

In this report the research work encompassed two classes of antenna analyses. One was an investigation of the effects of a nearby object upon an antenna and its performance and the other was a study of the center-fed, circular microstrip antenna. GRA

N80-28605# City Coll. of the City Univ. of New York. Communications Systems Lab.
RESEARCH ON ADAPTIVE DELTA MODULATORS Final Report, Mar. 1978 - Oct. 1979
V. R. Dhadesugoor, C. Ziegler, D. L. Schilling, M. Dressler, and S. Davidovici 1 Oct. 1979 86 p refs
(Contract MDA903-78-C-0182; ARPA Order 3534)
(AD-A085115; ARPA-FR-1) Avail: NTIS HC A05/MF A01 CSCL 17/2

This report summarizes our results of Voice encoding and video encoding using adaptive delta modulation. Topics include: packet loss, algorithm adaptation, variable rate algorithms, silence detection algorithms, design of a packet voice transmission system, slow-scan video encoding, packet destruction and frame-change detection. GRA

N80-28606# Illinois Univ. at Urbana-Champaign. Electromagnetics Lab.
DIELECTRIC ANTENNAS FOR MILLIMETER-WAVE APPLICATIONS Interim Report
S. Kobayashi, R. Lamde, R. Mittra, and S. Ray May 1980 67 p refs
(Grant DAAG29-77-G-0111)
(AD-A085302; UIEM-80-3; UILU-ENG-80-2543; ARO-14686.8-EL) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report describes the results of an investigation of dielectric-based antennas for millimeter wavelengths. Two types of antennas have been studied, viz., uniform and tapered dielectric rod antennas of rectangular cross-section which radiate in the endfire direction; and dielectric rods with discontinuities which perform as frequency scannable leaky-wave antennas. Experimental and theoretic design information and measured data on radiation pattern of both types of antennas are provided in the paper. GRA

N80-28607# Naval Underwater Systems Center, New London, Conn. Surface Ship Sonar Systems Dept.
ELASTIC WAVE PROPAGATION INHOMOGENEOUS LOSSY MEDIA WITH SPECIAL REFERENCE TO POWDERS
Geoffrey Roy Akers 28 Apr. 1980 151 p refs
(AD-A085262; NUSC-TR-6265) Avail: NTIS HC A08/MF A01 CSCL 20/11

Elastic wave propagation in actual fact is the transport of energy in a medium that acts as a sink for this energy. Engineering and physical applications rely upon an understanding of the wave propagation process to model systems and describe the physical world, and, as such one desires to broaden his knowledge of the actual propagation process in real inhomogeneous media. In this work, on examines the vector wave equation developed for an anisotropic, inhomogeneous lossy medium with a set of (effective) Lame: constants derived from microscopic considerations of the medium and develops a composite loss function, L to account for the energy loss mechanisms that occur as the wave propagates. This loss function is incorporated into the general equations of motion and series solutions for bulk, and surface waves in the inhomogenous lossy medium are derived. The displacement fields are examined over the frequency regime in the near and far field for the waves. The effective Lame: parameters are included in the solution, and their contribution, as well as the frequency contribution to the wave field is seen. Higher orders of scattering and diffraction are seen as well as the an harmonicites and nonlinear effects of losses. These effects may be observed in the general wavefield description. Also the effect of losses on the dispersion behavior is observed as a frequency shift of the wave. GRA

N80-28608# Utah State Univ., Logan. Dept. of Mathematics.
RAYLEIGH-BLOCH WAVE EXPANSIONS FOR DIFFRACTION GRATINGS, 1
Calvin H. Wilcox Mar. 1980 75 p refs
(Contract N00014-76-C-0276; NR Proj. 041-370)
(AD-A084939; TR-37) Avail: NTIS HC A04/MF A01 CSCL 20/14

Plane diffraction gratings with period 2 pi lying in a strip 0 - y - h in the x,y-plane are studied. A Rayleigh Bloch (R-B) wave for a grating is the response Psi sub - (x,y,p,q) to a plane wave 1/2 pi exp(i(px-qy)) incident from y = h (p eta R, q = 0). The paper presents a construction of R-B waves and a proof that (psi sub - (x,y,p,q)/p eta R, q = 0) is a complete orthogonal family in L(2)(G) in the sense of the Plancherel theory. GRA

N80-28609# ITT Gilfillan, Inc., Van Nuys, Calif.
TACTICAL RADAR TECHNOLOGY STUDY. VOLUME 1: EXECUTIVE SUMMARY Final Technical Report
Ronald Rosien, Leo Cardone, David Hammers, Albert Klein, and Edward Nozawa Griffiss AFB, N.Y. RADC Mar. 1980 27 p

2 Vol.
(Contract F30602-79-C-0026; AF Proj. 4506)
(AD-A084839; RADC-TR-80-48-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report presents results of a study to identify new technology required to provide advanced multi-threat performance capabilities in future tactical surveillance radar designs. A baseline design with optional subsystem characteristics has been synthesized to provide both functional and operational survivability in a dynamic and hostile situation postulated for the post 1985 time frame. Comparisons have been made of available technology with that required by the new baseline design to identify new technology requirements. Recommendations are presented for critical new technology programs including estimates of technical risks, costs and required development time. GRA

N80-28610# ITT Gilfillan, Inc., Van Nuys, Calif.
TACTICAL RADAR TECHNOLOGY STUDY, VOLUME 2 Final Technical Report
Ronald Rosien, Leo Cardone, David Hammers, Robert Klein, and Edward Nozawa Griffiss AFB, N.Y. RADC Mar. 1980 247 p 2 Vol.
(Contract F30602-79-C-0026)
(AD-A084885; RADC-TR-80-48-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 17/9

Technology required to provide advanced multithreat performance capabilities in future tactical surveillance radar designs is identified. The results of steps leading to the identification of such technology are summarized. The steps include: an analysis of current threats and those expected in 1990s; a determination of the functions, operations, and missions of the TACS and its sensors and the environment in which they operate; and formulating a baseline advanced tactical radar against which current and future technology can be evaluated. The baseline ATR system synthesized meets the mission and threat requirements of the post 1985 era. This multiple function radar combines an antenna/transmitter with advanced signal processing techniques to automatically track and report targets in a heavy ECM environment. E.D.K.

N80-28611# Princeton Univ., N. J. Plasma Physics Lab.
PHASED WAVEGUIDE ARRAY WITH FIXED TUNING ELEMENTS
R. W. Motley, S. Bernabei, W. M. Hooke, and F. J. Paoloni Apr. 1980 24 p refs
(Contract EY-76-C-02-3073)
(PPPL-1651) Avail: NTIS HC A02/MF A01

The waveguide grill excites both penetrating lower hybrid waves and surface plasma waves. Quarter wavelength tuning elements attached to the sides of a twin waveguide are shown to reduce the surface wave component by a factor about of 3. DOE

N80-28612# Fondazione Ugo Bordoni, Rome (Italy).
COST MINIMIZATION OF A SPARE TRANSMITTING MEDIA NETWORK [MINIMIZZAZIONE DEL COSTO DI UNA RETE DI MEZZI TRANSMISSIVI DI RISERVA]
Ugo Mocci and Giacomo Ravaioli Dec. 1978 44 p refs In ITALIAN
(FUB-39-1978) Avail: NTIS HC A03/MF A01

The mathematical formulation used to determine the minimum cost network that can bypass the blocked branch in the case of failure of only one transmitting element each time is described. A limited cost spare network was specified, for which the network availability is maximum. It is shown in two examples that by limiting the cost of the spare network to 20% it is possible to solve service interruption in 48% and 62% of the cases, respectively. Author (ESA)

N80-28613# Fondazione Ugo Bordoni, Rome (Italy).
CALCULATION OF ATTENUATION AND PHASE SHIFT BY UNIT LENGTH DUE TO RAIN CONSISTING OF ELLIPSOIDAL DROPS [CALCOLO DELLA ATTENUAZIONE E DELLO SFASAMENTO PER UNITA' DI LUNGHEZZA DOVUTI A PIOGGIA COSTITUITA DA GOCCE ELLISSOIDALI]
Dario Maggiori May 1978 54 p refs In ITALIAN
(FUB-43-1978) Avail: NTIS HC A04/MF A01

The physical models of electromagnetic wave diffusion for spherical and ellipsoidal rain drops are used to determine attenuation coefficients and phase shift in the range frequency between 10 and 100 GHz for several polarization conditions. The results are presented in table form as a function of rain parameters and frequency. Author (ESA)

N80-28614# Fondazione Ugo Bordoni, Rome (Italy).
RESEARCH PROGRAM ON THE RADIO PROPAGATION AT FREQUENCIES ABOVE 10 GHz: HYDROMETEOROLOGICAL DATA IN ITALY [PROGRAMMA DI RICERCA SULLA RADIOPROPAGAZIONE A FREQUENZE SUPERIORI A 10 GHz: DATI IDROMETEOROLOGICI NEL TERRITORIO NAZIONALE]
Francesco Barbaliscia and Francesco Fedi Jul. 1978 37 p refs In ITALIAN
(FUB-44-1978) Avail: NTIS HC A03/MF A01

An analysis of hydrometeorological data acquisition systems was performed to define the experimental work program. Data of the number of events and their average duration for several stations are presented. It is shown that the time distribution of rain is of primary importance for telecommunication networks, implying that time resolution, used up till now, is not sufficient. Author (ESA)

N80-28615# Fondazione Ugo Bordoni, Rome (Italy).
PERFORMANCE OF AN ATTENUATION MEASURING SYSTEM AT 11 AND 17.8 GHz [PRESTAZIONI DEL SISTEMA DI MISURA DELL'ATTENUAZIONE DI TRATTA A 11 E 17.8 GHZ]
Francesco Fedi and Piergiorgio Miglionini Dec. 1978 25 p refs In ITALIAN
(FUB-45-1978) Avail: NTIS HC A02/MF A01

The link attenuation due to rain was measured over a period of 3 years in an experimental link of 9.5 km length. The instrumentation used in the tests is described. It is concluded that the measuring error is 0.4 dB for 11 GHz and 0.45 dB for 17.8 GHz. Some other perturbations that were observed are not considered related to the measuring system. Author (ESA)

N80-28616# Fondazione Ugo Bordoni, Rome (Italy).
CUMULATIVE DISTRIBUTION FUNCTION OF THE ATTENUATION CAUSED BY THE RAIN OVER A LENGTH OF 9.5 KM AT 11 AND 17.8 GHz [FUNZIONI DI DISTRIBUZIONE CUMULATIVA DELL'ATTENUAZIONE DOVUTA A PIOGGIA SU UNA TRATTA DI 9.65 KM A 11 E 17.8 GHZ]
Francesco Fedi and Piergiorgio Miglionini Dec. 1978 40 p refs In ITALIAN
(FUB-46-1978) Avail: NTIS HC A03/MF A01

Two experiments with vertical polarization and one with horizontal polarization were performed through 120 rain events between 1974 and 1977. It is shown that the attenuation due to rain increases with frequency and is larger for horizontal polarization. It is also concluded that several years of observation are needed to define with statistical significance the attenuation for time fractions below 30 minutes per year. The relationship between the Q factor and the time fraction is described, showing that this relationship is independent of the frequency or polarization. Author (ESA)

N80-28617# Fondazione Ugo Bordoni, Rome (Italy).
ESTIMATION METHODS OF ATTENUATION AND CROSS-POLARIZATION DUE TO RAIN AND MULTIPLE PATHS AND EVALUATION OF THE EFFICIENCY OF PATH DIVERSITY AND SPACE DIVERSITY [METODI DI PREVISIONE DI ATTENUAZIONE E CROSS-POLARIZZAZIONE DOVUTE A PIOGGIA E CAMMINI MULTIPLE E VALUTAZIONE DELL'EFFICACIA DELLA DIVERSITA' DI PERCORSO E DI SPAZIO]
Angelo Bernardini (Rome Univ.) and Dario DiZenobio Dec. 1978 51 p refs In ITALIAN
(FUB-47-1978) Avail: NTIS HC A04/MF A01

A model to characterize the behavior of radio links in the 19 GHz band subjected to rain in the transmitting path is discussed. The methods for evaluation of the attenuation and cross-polarization due to rain are described and used for modeling the system behavior. The design of radio links using path diversity and space diversity between receiving antennas vertically distanced

is examined, and expressions are presented which describe the fading improving factors as a function of design variables.
Author (ESA)

N80-28618# Fondazione Ugo Bordoni, Rome (Italy).
NUMERICAL TRANSMISSION SYSTEM OF THE 5TH ORDER ON COAXIAL CABLE 2.6/9.5 mm: EVALUATION OF SOME CHARACTERISTIC LINE SYSTEM PARAMETERS USING REGENERATIVE AND HYBRID TYPE SOLUTIONS [SISTEMA DI TRANSMISSIONE NUMERICA DEL QUINTO ORDINE GERARCHICO SU CAVO COASSIALE 2.6/9.5 MM: VALUTAZIONE DI ALCUNI PARAMETRI CARATTERISTICI DEL SISTEMA DI LINEA CON SOLUZIONI SIA DI TIPO PURAMENTE RIGENERATIVO CHE DI TIPO IBRIDO]
Luigi Giacomelli (Rome Univ.) and Aldo Roveri (Rome Univ.) Dec. 1978 40 p refs In ITALIAN
(FUB-48-1978) Avail: NTIS HC A03/MF A01

The design of a 5th order pulse code modulation system at a binary rate of 840 M bit/s (equivalent to 11,520 telephonic circuits) is discussed, in order to provide complementary alternatives to the 60 MHz frequency division multiplexing system being adopted by the Italian telecommunication network. Tables are presented showing relevant parameters for several design alternatives for both purely regenerative and hybrid systems.
Author (ESA)

N80-28619# Fondazione Ugo Bordoni, Rome (Italy).
RELIABILITY OF COMMUNICATION NETWORKS [SULL'AFFIDABILITA' DELLE RETI DI COMMUNICAZIONE]
Maurizio Decina (Rome Univ.) May 1979 33 p refs In ITALIAN
(FUB-3-1979) Avail: NTIS HC A03/MF A01

Criteria based upon traffic or upon the connectivity of a communications network for evaluating its reliability were examined. The traffic-based criteria were studied for circuit switching networks and for message or packet switching networks. The problem of the synthesis of reliable networks was also analyzed.
Author (ESA)

N80-28620# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
CALCULATION OF APERTURE AND FAR-FIELD DISTRIBUTIONS FROM MEASUREMENTS IN THE FRESNEL ZONE OF LARGE REFLECTOR ANTENNAS
C. A. M. Geus and J. Dijk Aug. 1978 90 p refs
(TH-78-E-87; ISBN-90-6144-087-4) Avail: NTIS HC A05/MF A01

Aperture fields and radiation patterns from Fresnel field measurements of both amplitude and phase distributions radiated by large reflector antennas were calculated. A microwave measurement system based on the concept of microwave complex holograms was introduced. Equations for the Fresnel field of a large reflector antenna on a spherical surface were derived, and the transformations necessary to calculate aperture and far fields given. The cross-polarization properties in the Fresnel zone were investigated. For small boresight angles the copolarized and cross polarized field distributions were shown to be independent of copolarized and cross polarized aperture fields respectively. It is shown that an antenna test range of about 15 times the diameter of the reflector is necessary to carry out Fresnel field measurements. Equations defining the angular test interval and the sampling distance were derived.
Author (ESA)

N80-28621# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
REDUCING THE NUMBER OF COMPUTATIONS IN STACK DECODING OF CONVOLUTIONAL CODES BY EXPLOITING SYMMETRIES OF THE ENCODER
A. J. Vinck and A. J. P. dePaepe Sep. 1978 47 p refs Sponsored in part by Netherlands Organization for Advancement of Pure Research (ZWO)
(TH-78-E-90; ISBN-90-6144-090-4) Avail: NTIS HC A03/MF A01

A method of decoding of convolutional codes is described, where the decoding algorithm looks for an information-vector correction sequence, that must be added to the inverse of the received data vector sequence. This is in contrast with the usual method, tries to estimate the information vector sequence directly. Both methods are equally complex for a maximum likelihood (ML) decoder. In sequential decoding, with hard as well as with soft decisions, symmetries of the code can be exploited to reduce the number of computations and hence, the erasure probability. This is illustrated by simulation results. The method is similar to the use of state space symmetries of the syndrome former to obtain a reduction in the exponential rate of growth of the hardware of a Viterbi-like syndrome decoder.
Author (ESA)

N80-28622# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
DIPOLE SCATTERING OF ELECTROMAGNETIC WAVES PROPAGATING THROUGH A RAIN MEDIUM
C. A. vanDuin Jan. 1979 48 p refs
(TH-79-E-93; ISBN-90-6144-093-9) Avail: NTIS HC A03/MF A01

The propagation of a plane linearly polarized monochromatic electromagnetic wave through a rain medium was studied theoretically. The presence of the rain medium causes damping and depolarization of the incident wave. The depolarization effects are a consequence of the anisotropy of the rain medium: raindrops are not spherical. Axisymmetric oblate spheroidal raindrops were assumed. A dipole model was used to describe the scattering and absorption of the wave traveling through the medium. It is shown that the scattering problem described can be reduced to a first order differential equation. Numerical data for the complex forward scattering amplitudes of a linearly polarized wave incident on an axisymmetric water drop at different frequencies and computation of the relevant quantities.
Author (ESA)

N80-28623# National Technical Information Service, Springfield, Va.
SPREAD SPECTRUM COMMUNICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
William E. Reed Apr. 1980 131 p Supersedes NTIS/PS-79/0494; NTIS/PS-78/0489
(PB80-809726; NTIS/PS-79/0494; NTIS/PS-78/0489) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

The bibliography cites Federally-funded research on the techniques, equipment, and applications of spread spectrum communications. Topics include pseudonoise modulation, coding, signal processing, synchronization, antijamming, interference rejection, antennas, and the use of surface acoustic wave technology. Applications include satellite, television, secure communication, multiplex, and multiple access system. This updated bibliography contains 124 abstracts, 25 of which are new entries to the previous edition.
GRA

N80-28624# National Technical Information Service, Springfield, Va.
SPREAD SPECTRUM COMMUNICATION. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Apr. 1980
William E. Reed Apr. 1980 170 p Supersedes NTIS/PS-79/0495; NTIS/PS-78/0490
(PB80-809734; NTIS/PS-79/0495; NTIS/PS-78/0490) Avail: NTIS HC $30.00/MF $30.00 CSCL 17B

Research reports from worldwide literature are cited on the techniques, equipment, and applications of spread spectrum communications. Topics include pseudonoise modulation, coding, signal processing, synchronization, antijamming interference rejection, antennas, and the use of surface acoustic wave technology. Applications include satellite, secure communication, multiplex;, and multiple access systems. This updated bibliography contains 163 abstracts, 45 of which are new entries to the previous edition.
GRA

N80-28625# National Technical Information Service, Springfield, Va.
ANTENNA ARRAYS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Apr. 1980
William E. Reed Apr. 1980 168 p Supersedes NTIS/PS-79/0318; NTIS/PS-78/0310
(PB80-809742; NTIS/PS-79/0318; NTIS/PS-78/0310) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

A bibliography containing 161 abstracts concerning the use of antenna arrays in the fields of radar, communications, radio astronomy, navigation, electronic countermeasures, and spacecraft is presented. Topics include design, antenna radiation patterns, mathematical models, and performance. GRA

N80-28626# National Technical Information Service, Springfield, Va.
ANTENNA ARRAYS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1980
William E. Reed Apr. 1980 261 p Supersedes NTIS/PS-79/0319; NTIS/PS-78/0311
(PB80-809759; NTIS/PS-79/0319; NTIS/PS-79/0311) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

A bibliography containing 254 abstracts concerning antenna arrays is given. Topics include design, propagation, antenna radiation patterns, mathematical analysis, signal processing, and interference rejection. GRA

N80-28627# Institute for Telecommunication Sciences and Aeronomy, Boulder, Colo.
PROPAGATION EFFECTS OF AN INTERVISIBILITY MEASUREMENT SYSTEM OPERATING IN THE SHF BAND
E. J. Haakinson, E. J. Violette, and G. A. Hufford Feb. 1980 138 p refs Sponsored in part by Army Combat Developments Experimentation Command, Ft. Ord, Calif.
(PB80-167471; NTIA/Rept-80/35) Avail: NTIS HC A07/MF A01 CSCL 14B

A study was conducted to determine the limiting propagation effects on the performance of a microwave system that could be used to detect the optical visibility to one another of two vehicles, separated by up to 10 km, in irregular, obstructed terrain. The study had four objectives: (1) to demonstrate what effects signal variability has on the intervisibility decision process; (2) to identify the possible sources of the signal variability and to estimate the magnitude of each source's contribution to the total variability; (3) to obtain propagation loss data, over various types of terrain and obstructed paths, which could be used to predict received signal variability due to propagation over similar paths; and (4) to use the measured data to determine the performance of simulated intervisibility measurement system. A measurement system was prepared and sent to Ft. Hunter Liggett, CA, where propagation path loss was measured over several selected paths of varying lengths, varying path geometrics, and varying amounts of vegetation and rock outcroppings. GRA

N80-28628# Mitre Corp., McLean, Va. Metrek Div.
DEVELOPMENT OF AN EXPERIMENTAL SPREAD SPECTRUM MARITIME COMMUNICATION SYSTEM, PHASE 1
Walter C. Scales Jul. 1979 75 p refs
(Contract DO-A01-78-3108)
(PB80-169881; MTR-79W00217; MA-RD-940-80005) Avail: NTIS HC A04/MF A01 CSCL 17B

This report summarizes the results of the first phase of an investigation of a spread spectrum technique for maritime applications. Potential applications include distress signaling via satellite, remote monitoring of ship performance, and 'orderwire' signaling for future maritime satellite communication systems. The specific approach developed under this contract provides for low power, low data rate transmission through a maritime communications satellite. The receiver designed for this application uses a matched filter based on charge transfer devices. A baseband receiver was demonstrated during the first project phase. The second phase, which is now approaching completion, will encompass extension of the hardware to an intermediate frequency and testing via satellite. GRA

N80-28629# Federal Communications Commission, Washington, D. C. Office of Plans and Policy.
APPENDICES TO REPORT OF THE UHF TASK FORCE Final Report
Raymond M. Wilmotte 1979 195 p refs 2 Vol.
(PB80-164429) Avail: NTIS HC A09/MF A01 CSCL 17B

Several articles are presented which address various problems in ultrahigh frequency communications inlcuding the interaction of decision makers and analysts, speech and television bandwidth reduction, compandored single sideband, the introduction of marketplace forces for the development of spectrum efficiency, spectrum requirements for civil maritime and aeronautical services, and determining preferences for UHF allocations. GRA

N80-28630# Federal Communications Commission, Washington, D. C. Office Plans and Policy.
FINAL REPORT OF THE UHF TASK FORCE Final Report
Raymond M. Wilmotte Sep. 1979 54 p 2 Vol.
(PB80-164437) Avail: NTIS HC A04/MF A01 CSCL 17B

The major services in the ultrahigh frequency band-television, civil maritime, civil aeronautics, and land mobile, are analyzed with respect to the expected demand to the end of the century and the spectrum space that each would require to meet this demand as well as that of new services likely to emerge. The capacity of the communication system would depend on the development of spectrum saving procedures and technology. Just as important and just as difficult would be the means for their introduction into the national telecommunication system. Whatever process was developed, it would have to be flexible to meet unexpected fluctuations and have some leeway to grow in the first few years of the next century. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-28631 Pittsburgh Univ., Pa.
ARC-CIRCUIT INTERACTION INCLUDING THE EFFECT OF PRE-CURRENT ZERO ARC INSTABILITY Ph.D. Thesis
Avelino Juan Gonzalez 1979 162 p
Avail: Univ. Microfilms Order No. 8015379

A computer arc model is developed which is capable of predicting the point of arc instability and simulate the subsequent current chop. It can also determine the level of current chopped and the response of the system to the phenomenon. The model is inserted in a computer algorithm which uses the conductance of the arc and the nodal equations of the electrical system to which the interrupter is connected to compute the arc voltage and current at every time interval. The level of current chopped (i sub ch) at different values of the line-side breaker capacitance CG is determined. The resulting graph of I sub ch vs CG is compared to results obtained experimentally, which qualitatively verifies the validity of the model. A theoretical comparison is made between connecting the capacitance from the line-side breaker terminal to ground versus connecting the same value of capacitance directly across the breaker contacts. The model predicted no significant difference in arc stability between the two configurations. However, pertaining to the transient recovery voltage (TRV) the position of line-side breaker capacitance CG produced less severe TRVs at low values of capacitance when compared to the same capacitance connected across the gap. The converse was true at higher values of capacitance. Dissert. Abstr.

N80-28632 Ohio State Univ., Columbus.
THE ANALYSIS OF THE R.F. FIELD RESPONSE OF SOLID WIRES EXCITED BY LASER INDUCED ENDCAP CURRENTS Ph.D. Thesis
Kenneth Robert Demarest 1980 97 p
Avail: Univ. Microfilms Order No. 8015866

A technique for calculating the current and field response of an end excited monopole is presented. This formulation is a variation of the Fourier transform technique and models the dipole (the monopole and its ground plane image) as a member of an infinite, periodic array (of sufficient spacing to negate coupling effects) of identically excited wires. The array geometry is divided into two distinct regions, and complete field expansions are constructed that satisfy the appropriate boundary and source conditions of each region. Solutions are obtained by requiring

these expansions to satisfy the necessary boundary conditions along the extended wire surfaces through the use of a Fourier Galerkin matching technique. Wire responses as calculated by this technique are presented which demonstrate their basic characteristics as a function of critical wire and source parameters. Special attention is drawn to the current response in the end regions and its dominance by the currents incident from the source filament. Calculated transient responses are also presented and shown to exhibit excellent agreement with measured responses. Dissert. Abstr.

N80-28633 Oklahoma State Univ., Stillwater.
WAVEFORM EFFECTS ON THE OPERATION OF THE PARALLEL-BRIDGE RECTIFIER SYSTEM AND THE FIELD Ph.D. Thesis
Altaf-UR Rahman 1979 169 p
Avail: Univ. Microfilms Order No. 8013041

The influence of nonsinusoidal (especially flat topped) source voltage waveforms on the operation of the parallel bridge rectifier system (PBRS) and the field modulated generator system (FMGS), leading to the development of some practical design guidelines for the FMGS. Emphasis is given to the following: (1) the effect of rectangular pulse source voltage waveform on the operation of the PBRS; (2) the effect of trapezoidal source voltage waveform on the operation of the PBRS with bridge-input capacitors; (3) some practical design guidelines; and (4) the validity of the theoretical results. Dissert. Abstr.

N80-28634 Purdue Univ., Lafayette, Ind.
RESISTOR CONDUCTOR INTERFACE IN THICK FILM Ph.D. Thesis
Dinesh Tandan 1979 158 p
Avail: Univ. Microfilms Order No. 8015526

Intermigration of conducting phases at the resistor-conductor was studied using the scanning electron microscope (SEM). The interfaces between both Au and Pt frit bonded conductors (containing lead borosilicate glass of composition 63 w/o PbO -25 w/o B2O3 - 12 w/o SiO2) and resistors made with RuO2 and the same lead borosilicate glass were considered for normal firing temperature and time. It was observed that the overlap region of conducting phases was equal to or less than 3 microns, which was about the sensitivity of the instrument. The microstructural changes at the resistor-conductor interface during firing were observed using a hot stage microscope. It was observed that the conductor pad shrinks during firing, and that glass flows out of the pad and into the interface region between the resistor body and the conductor pad producing a segregation region on the resistor side of the resistor-conductor interface. Dissert. Abstr.

N80-28635*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PHOTOCAPACITIVE IMAGE CONVERTER Patent Application
William E. Miller, Arden Sher (Coll. of William and Mary, Williamsburg, Va.), and Yuan Huai Tsuo (Coll. of William and Mary, Williamsburg, Va.) 20 Jun. 1980 14 p
(NASA-Case-LAR-12513-1; US-Patent-Appl-SN-161256) Avail: NTIS HC A02/MF A01 CSCL 09A

Apparatus is described for converting a radiant energy image into corresponding electrical signals including an image converter. The image converter includes a substrate of semiconductor material, an insulating layer on the front surface of the substrate and an electrical contact on the back surface of the substrate. A series of parallel transparent conductive stripes is on the insulating layer with a processing circuit connected to each of the conductive stripes for detecting the modulated voltages generated. In a first embodiment of the invention, a modulated light stripe, perpendicular to the conductive stripes scans the image converter. The resulting modulated signals generated on the conductive stripes are detected by the processing circuits to produce signals that represent the image focused on the image converter. In a second embodiment of the invention a second insulating layer is deposited over the conductive stripes, and a second series of parallel transparent conductive stripes perpendicular to the first series is on the second insulating layer. A different frequency current signal F sub n is applied to each of the second series of conductive stripes, and a modulated image is applied to the image converter. The resulting signals detected by the processing circuits represent the image. NASA

N80-28636*# Auburn Univ., Ala. Dept. of Electrical Engineering.
EVALUATION OF INDUCTION MOTOR PERFORMANCE USING AN ELECTRONIC POWER FACTOR CONTROLLER Final Report
21 Jun. 1978 55 p
(Contract NCA8-00128)
(NASA-CR-161506) Avail: NTIS HC A04/MF A01 CSCL 09A

The concept of reducing the losses in an induction motor by electronically controlling the time interval between the zero crossing of the applied voltage and the zero crossing of the armature current was evaluated. The effect on power losses and power factor of reducing the applied sinusoidal voltages below the rated value was investigated experimentally. The reduction in power losses was measured using an electronic controller designed and built at MSFC. Modifications to the MSFC controller are described as well as a manually controlled electronic device which does not require that the motor be wye connected and the neutral available. Possible energy savings are examined. A.R.H.

N80-28637*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE DEVELOPMENT OF A STEPPED FREQUENCY MICROWAVE RADIOMETER AND ITS APPLICATION TO REMOTE SENSING OF THE EARTH
Richard F. Harrington Jun. 1980 181 p refs
(NASA-TM-81847) Avail: NTIS HC A09/MF A01 CSCL 09C

The design, development, application, and capabilities of a variable frequency microwave radiometer are described. This radiometer demonstrated the versatility, accuracy, and stability required to provide contributions to the geophysical understanding of ocean and ice processes. A closed-loop feedback method was used, whereby noise pulses were added to the received electromagnetic radiation to achieve a null balance in a Dicke switched radiometer. Stability was achieved through the use of a constant temperature enclosure around the low loss microwave front end. The Dicke reference temperature was maintained to an absolute accuracy of 0.1 K using a closed-loop proportional temperature controller. A microprocessor based digital controller operates the radiometer and records the data on computer compatible tapes. This radiometer exhibits an absolute accuracy of better than 0.5 K when the sensitivity is 0.1 K. The sensitivity varies between 0.0125 K and 1.25 K depending upon the bandwidth and integration time selected by the digital controller. Remote sensing experiments were conducted from an aircraft platform and the first radiometeric mapping of an ocean polar front; exploratory experiments to measure the thickness of lake ice; first discrimination between first year and multiyear ice below 10 GHz; and the first known measurements of frequency sensitive characteristics of sea ice. L.F.M.

N80-28638*# Hughes Aircraft Co., Culver City, Calif.
QUANTITATIVE OPTICAL SCANNING TESTS OF COMPLEX MICROCIRCUITS Final Report, Feb. 1978 - Jan. 1980
J. J. Erickson Mar. 1980 119 p
(Contract NAS8-32665)
(NASA-CR-161522; HAC-1476) Avail: NTIS HC A06/MF A01 CSCL 09C

An approach for the development of the optical scanner as a screening inspection instrument for microcircuits involves comparing the quantitative differences in photoresponse images and then correlating them with electrical parameter differences in test devices. The existing optical scanner was modified so that the photoresponse data could be recorded and subsequently digitized. A method was devised for applying digital image processing techniques to the digitized photoresponse data in order to quantitatively compare the data. Electrical tests were performed and photoresponse images were recorded before and following life test intervals on two groups of test devices. Correlations were made between differences or changes in the electrical parameters of the test devices. A.R.H.

N80-28639# Purdue Univ., Lafayette, Ind. Turner Lab. for Electroceramics.
THE EFFECTS OF SUBSTRATE COMPOSITION OF THICK FILM CIRCUIT RELIABILITY Final Report, 1 Feb. 1979 - 31 Jan. 1980
R. W. Vest 28 Feb. 1980 118 p refs
(Contract N00019-79-C-0240)
(AD-A084261) Avail: NTIS HC A06/MF A01 CSCL 09/1

The dissolution of an alumina substrate (AlSiMag 614) into the glass phase of a thick film resistor during firing was found to markedly increase the viscosity, and to decrease the surface tension and density of the glass. These changes in glass properties cause an increase in the sheet resistance and a decrease in the TCR of the resistors. The minor constituents in the substrate were found to exert a larger effect on glass properties than their concentration (4%) suggests. The models for microstructure development and charge transport in thick film resistors were modified in order to accommodate the effect of the resistor-substrate interaction. The results of this study led to specific recommendations for quality control of substrate chemistry, and for composition of resistor glasses. GRA

N80-28640# Harry Diamond Labs., Adelphi, Md.
FLUERICS 41: SINGLE-SIDED CONTROL PORT CHARACTERISTICS OF LAMINAR PROPORTIONAL AMPLIFIERS FOR ARBITRARY INPUT LOADING
R. Michael Phillipi and Tadeusz M. Drzewiecki Feb. 1980 30 p
(DA Proj. 1L1-61102-AH-44)
(AD-A084180; HDL-TR-1901) Avail: NTIS HC A03/MF A01 CSCL 13/7

This report presents a technique for analytically predicting single-sided control port characteristics of a laminar proportional amplifier (LPA) with arbitrary input circuits at the opposite control using calculable differential characteristics. Specific cases dealt with include a constant pressure at the opposite control, a constant flow at the opposite control, and a series and shunt flow resistance at the opposite control. Experiments using amplifiers at various aspect ratios (height-to-width ratio of supply nozzle) and supply pressures, which imply a large range of LPA resistance, show a maximum error of 11 percent between actual and computed single-sided control port flow resistance. GRA

N80-28641# Harry Diamond Labs., Adelphi, Md.
CHARACTERISTICS OF OROTRON OSCILLATION AND AMPLIFICATION. 2: LINEAR BUNCHING THEORY
Richard P. Leavitt, Clyde A. Morrison, and Donald E. Wortman Mar. 1980 22 p refs
(DA Proj. 1L1-61101-A-91A)
(AD-A084714; HDL-TR-1898) Avail: NTIS HC A02/MF A01 CSCL 09/5

A linear theory of bunching in the orotron is derived in which the electron beam evolves in time via the Boltzmann equation. The theory is used to derive the power radiated by an electron beam subjected to a general longitudinal electric field. It is then specialized to the case of the orotron, in which the electric field is quasi-periodic. The starting current, I sub s, and the electronic tuning transconductance, dI/dV, are calculated from the theory. These results are evaluated for the planned Harry Diamond Laboratories orotron experiment at 75 gigahertz and are found to be I sub s = 34.5 milliamperes and dI/dV = 0.31 megahertz/volt. GRA

N80-28642# Lincoln Lab., Mass. Inst. of Tech., Lexington.
ELECTROOPTICAL DEVICES Semiannual Technical Summary Report, 1 Apr. - 30 Sep. 1979
Charles E. Hurwitz 30 Sep. 1979 30 p refs
(Contract F19628-80-C-0002; AF Proj. 2306; AF Proj. 4600)
(AD-A084410; ESD-TR-79-279) Avail: NTIS HC A03/MF A01 CSCL 09/3

The current objectives of the electrooptical device program are (1) to perform life tests on GaInAsP/InP Double-heterostructure (DH) diode lasers operating in the 1.0 to 1.3 micrometer wavelength region and analyze the degradation mechanism; and (2) to fabricate and study avalance photodies of similar composition GaInAsP operating in the same wavelength region. Self-sustained pulsations in light output, similar to those occurring in AlGaAs lasers, were studied in GaInAsP DH lasers. In marked contrast of observations for AlGaAs lasers, the rate of incidence of the pulsations is much lower and their occurrence does not appear to be increased by aging. The pulsations appear to be related to defects originating in the growth process or subsequent fabrication procedures. Substantial increase in avalance gain and reduction of dark current have been achieved in a modified version of the inverted-mesa GaInAsP/InP avalance photodiode structure. Dark currents as low as 1.5 nA at half the breakdown voltage and photocurrent gans as high as 700 have been measured. Implantation of the donors Se, Si, And C and the acceptors Cd, Mg, and Be from room temperature to 200 C were studied. The sample temperature during implantation is to have a pronounced effect on the electrical characteristics of the resulting layers. Electron concentrations in excess of 10 to the 19th power per cc were achieved. GRA

N80-28643# Magnavox Government and Industrial Electronics Co., Fort Wayne, Ind.
ELECTRONICALLY TUNABLE AMPLIFIER Final Technical Report, Apr. 1978 - Apr. 1979
Winston A. Council Mar. 1980 59 p
(Contract F30602-78-C-0152; AF Proj. 0174)
(AD-A084089; RADC-TR-80-77) Avail: NTIS HC A04/MF A01 CSCL 09/5

This report describes a research effort intended to determine the feasibility of combining high power solid state amplifier and electronically tunable resonator technology. This new technology would be applicable to the design and fabrication of high power electronically tunable amplifiers capable of frequency agile operation in the UHF range. The primary goal of the effort was to determine if the RF power from twelve 100 watt solid state amplifier modules could be combined in the electric field of an electronically and/or mechanically tuned cavity resonator, to produce/kilowatt of continuous output power. Testing of the experimental model showed that efficient RF power combining could be obtained in a mechanically tuned cavity where the length of the coaxial inner element was varied to change the frequency. Summing with the electronic tuning technique (PIN diode switched loops) was inefficient and distortion of the RF field by the tuning loops within the cavity precludes tuning and summing at the same time. GRA

N80-28644# Naval Postgraduate School, Monterey, Calif.
EXPERIMENTAL STUDY OF SELF-SCANNING PHOTODIODE ARRAY M.S. Thesis
Carlos J. G. Martins Dec. 1979 61 p refs
(AD-A084519) Avail: NTIS HC A04/MF A01 CSCL 14/3

An experimental study of a new series of Solid State image sensor arrays was conducted, operating in a photon flux integration mode. The operation of a P-N junction photodiode is analyzed, and boundary conditions to operate the device are presented. The origin of the switching noise as the predominant noise source is verified. Some applications are developed. GRA

N80-28645# Texas A&I Univ., Kingsville. Dept. of Electrical Engineering.
AN ADAPTIVE PREDICTOR FOR DATE COMPRESSION Final Report
Michael Hankamer 31 Mar. 1980 78 p refs
(Grant AF-AFOSR-0074-79; AF Proj. 2304)
(AD-A084217; AFOSR-80-0418TR) Avail: NTIS HC A05/MF A01 CSCL 09/4

The problem of predicting the nth sample of a periodically stationary random sequence (digitized electrocardiogram using a set of L prior samples was considered. The entropy of the source was calculated using a Markov source model to find that entropy decreases rapidly with source order. The linear least mean square estimator was also derived and computer simulated. R.C.T.

N80-28646# RCA Advanced Technology Labs., Camden, N. J.
ANALOG-BINARY PROGRAMMABLE TRANSVERSAL FILTER Final Technical Report, 30 Sep. 1977 - 30 Jun. 1979
J. R. Tower and L. D. Elliott Griffiss AFB, N.Y. RADC Feb. 1980 43 p
(Contract F19628-77-C-0263; AF Proj. 4600)
(AD-A084346; RADC-TR-79-331) Avail: NTIS HC A03/MF A01 CSCL 09/5

This Final Technical Report on the Analog-Binary Programmable Transversal Filter program emphasizes the testing of the TC1235 CCD correlator device. The Interim Technical Report for this program contained a statement of the program objectives, a general description of the analog-binary correlator, and a detailed design description of the correlator device. The objective of this program was to develop a programmable CCD (Charge-Coupled Device) circuit capable of correlating a variety of binary-coded waveforms. This analog-binary correlator stores a binary waveform as a reference, and then compares newly arriving signals to the reference waveform. In general, the signal is a binary code that has been corrupted in the transmission channel so that upon arrival at the receiver, it really has an analog character (i.e., the amplitude varies continuously). Analog-binary correlation techniques have an important advantage over purely digital approaches. If the analog signal is directly compared to the reference, only a single correlation channel is required, whereas a digital correlator requires a separate channel for each bit of resolution in the analog-to-digital converter. Thus, a reduction in parts count, with attendant improvements in size, cost and reliability, is realized with the CCD correlator. GRA

N80-28647# Watkins-Johnson Co., Scotts Valley, Calif. Cathode-Ray Tube Dept.

HIGH CONTRAST CRT Final Technical Report, 1 Jan. 1977 - 30 Jun. 1979

Norman H. Lehrer and Glenn A. Holmquist Feb. 1980 128 p refs

(Contract DAAB07-77-C-2639; DA Proj. 1L1-62705-AH-94) (AD-A084687; DELET-TR-77-2639-F) Avail: NTIS HC A07/MF A01 CSCL 09/1

This program developed a CRT fabrication technology incorporating La_2O_2S:Tb and La_2O_2S:Eu thin film phosphor coated faceplates backed with a nonreflecting coating. The resulting color CRT is superior to existing monochromatic CRT's in high ambient light conditions. GRA

N80-28648# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.

MILLIMETER-WAVE SELF-MIXING InP AND GaAs GUNN OSCILLATORS

Samuel Dixon Jun. 1979 28 p refs

(DA Proj. 1L1-62705-AH-94) (AD-A085026; DELET-TR-79-4) Avail: NTIS HC A03/MF A01 CSCL 09/5

Self-oscillating mixers in both dielectric and waveguide cavities have been investigated in the 60 GHz frequency range. The devices consist of negative resistance diodes of GaAs and InP material coupled to waveguide cavities or high resistivity dielectric cavities such as silicon or Al_2O_3. Experimental measurements show that these devices have a sensitivity in the order of -80dBm with the intermediate frequency at 60 MHz and an IF bandwidth of 120 MHz. Applications are suggested based on minimum detectable signal and RF power capabilities for systems requiring small size and low cost. GRA

N80-28649# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.

CAUSAL AND TELEOLOGICAL REASONING IN CIRCUIT RECOGNITION

Johan De Kleer Sep. 1979 219 p refs

(Contract N00014-75-C-529; Grant NSF MSC-77-04828) (AD-A084802; AI-TR-529) Avail: NTIS HC A10/MF A01 CSCL 09/5

This thesis presents a theory of human-like reasoning in the general domain of designed physical systems, and in particular, electronic circuits. One aspect of the theory, causal analysis, describes how the behavior of individual components can be combined to explain the behavior of composite systems. Another aspect of the theory, teleological analysis, describes how the notion that the system has a purpose can be used to aid this causal analysis. The theory is implemented as a computer program, which, given a circuit topology, can construct by qualitative causal analysis a mechanism graph describing the functional topology of the system. This functional topology is then parsed by a grammar for common circuit functions. Ambiguities are introduced into the analysis by the often several possible mechanisms which might describe the circuit's function. These are disambiguated by teleological analysis. The requirement that each component be assigned an appropriate purpose in the functional topology imposes a severe constraint which eliminates all of the ambiguities. Since both analyses are based on heuristics, the chosen mechanism is a rationalization of how the circuit functions, and does not guarantee that the circuit actually does function. This type of coarse understanding of circuits is useful for analysis, design and troubleshooting. GRA

N80-28650# Naval Air Engineering Center, Lakehurst, N.J. Ground Support Equipment Dept.

INTEGRATED CIRCUIT TESTER EVALUATION STUDY Final Report, Jan. 1977 - Sep. 1978

P. Stevens 5 Mar. 1980 111 p refs

(AD-A084961; GIDEP-E150-0590; NAEC-MISC-92-0380) Avail: NTIS HC A06/MF A01 CSCL 09/5

The primary AIMD test requirements for a small, inexpensive, commercially available, digital IC tester could be met by only one tester. This was the Automatic Fault Isolation Tester (AFIT) model 2050 manufactured by Testline Co. Many other testers were available that had the basic testing capability but were outside the price constraints or that were edge board testers. Bed-of-nails testers were not considered for AIMD use. The AFIT was submitted for technical and User Evaluations and demonstrated that it could detect faulty IC's on PC boards not coated with a conformal moisture-proofing compound. This fault detection ability was demonstrated for both the in-circuit and out-of-circuit modes of operation. GRA

N80-28651# Rockwell International Corp., Cedar Rapids, Iowa. Collins Telecommunications Products Div.

TRANSCEIVER MULTIPLEXERS TD-1288/GRC AND TD-1289/GRC Annual Report, 1 Oct. 1978 - 30 Sep. 1979

D. Penner and J. Dean Mar. 1980 23 p

(Contract DAAB07-77-C0193) (AD-A085156; CORADCOM-77-0193-6; AR-2; Rept-523-0769373-00121D-2) Avail: NTIS HC A02/MF A01 CSCL 17/2

This annual report summarizes the activity on the VHF Transceiver Multicoupler for the year ending 30 September 1979. During the previous report period, the 2 channel and 5 channel multiplexers with an expanded upper frequency range of 88 MHz were developed. In addition to the expanded frequency range, a filter simulator was developed to substitute for any filter module in an unused channel. During this report period, final testing on the engineering models was completed and the design was finalized. Any resulting changes or discrepancies with the drawing package were then updated to insure conformance by the production models. Final assembly of the production units was begun in April with the first units being delivered to the engineering test area in June for the start of the engineering design test (qualification test). Results of this test are summarized. GRA

N80-28652# Southwest Research Inst., San Antonio, Tex.

FEDERAL EVALUATION OF LIGHTNING TRACKING SYSTEMS (FELTS) Final Report, 1 May 1979 - 31 May 1980

R. L. Johnson May 1980 44 p refs

(Contract N00014-79-C-0223) (AD-A084791) Avail: NTIS HC A03/MF A01 CSCL 17/3

A side-by-side performance evaluation of two lightning tracking systems was done at Kennedy Space Center, Florida during the period 1 June-13 July 1979. The competing systems were manufactured by Lightning Location and Protection Inc., (LLP) and by Atlantic Scientific Corp. (ASC). Although the ASC system satisfied a preliminary performance test, it was observed that the device required continuing modification by the manufacturer. The LLP system experienced two hardware failures during this period, but otherwise operated 24 hours daily in an automatic unattended data acquisition mode. Because of the continuing developmental effort required on the ASC device, it was determined that the operational evaluation of this system was premature. GRA

N80-28653# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab

SOME MODIFICATIONS TO NEWTON'S METHOD FOR THE DETERMINATION OF THE STEADY STATE RESPONSE OF

NONLINEAR CIRCUITS Ph.D. Thesis
Francis Benedict Grosz, Jr. Aug. 1979 140 p refs
(Contracts DAAB07-72-C-0259; N00014-79-C-0424; Grant DAAG29-78-G-0016)
(AD-A085256; R-856; UILU-ENG-78-2249) Avail: NTIS HC A07/MF A01 CSCL 09/3

Many methods have become available recently for the determination of the steady state response of nonlinear circuits. The Newton method of Trick, Aprille and Colon is one of the more widely available methods. However, in certain cases, the method fails to converge to a steady state solution. Three modifications to the Newton method to increase convergence reliability or speed are proposed. The implementation of these modifications is discussed. Several example circuits are given and the results compared. Some guidelines for the use of these modified methods are also given. GRA

N80-28654# Varian Associates, Beverly, Mass.
SFD-261 CROSSED-FIELD AMPLIFIER MANUFACTURING TECHNOLOGY PROGRAM, SUPPLEMENT Final Report
R. A. LaPlante and F. E. Trojan 16 May 1980 37 p
(Contract N00123-77-C-1019)
(AD-A085044; Rept-22-3040-FNL-Suppl) Avail: NTIS HC A03/MF A01 CSCL 09/5

Qualifications tests performed on ten crossed field amplifiers are reported. Findings regarding tube failures and corrective measures taken are included. E.D.K.

N80-28655# Varian Associates, Beverly, Mass.
SFD-261 CROSSED-FIELD AMPLIFIER MANUFACTURING TECHNOLOGY PROGRAM Final Report, Aug. 1977 - Sep. 1979
R. A. LaPlante and F. E. Trojan 28 Sep. 1980 108 p
(Contract N00123-77-C-1019)
(AD-A085043; Rept-22-3040-FNL) Avail: NTIS HC A06/MF A01 CSCL 09/5

The objective of the MT program is to demonstrate improved production techniques by a pilot production run of ten (10) tubes to meet performance specification and system compatibility criteria under production line conditions. The SFD-261 is a microwave amplifier used to increase the power level of pulses of energy by a factor of 20. It is used in the Aegis AN/SPY-1 radar transmitter. A single ship's complement without spares is seventy-six. Its internal parts are made from high purity copper and many are complex and involve high precision. Most of the fabrication is by precious metal brazing in hydrogen or in vacuum. Modest production rates (10 to 30 units per month) presently restrict the amount of automation which can be effectively applied. Nearly 30 design changes were made without altering performance significantly. Self-jigging techniques permitted assembly by lower skill levels. A 'one-shot' vacuum braze for the cathode produced significant cost and equipment reduction. If the selling price of the standard design is normalized at 100, the price of the MT design is now 57. GRA

N80-28656# Southern California Edison Co., Rosemead. Research and Development Div.
EPRI/SCE TESTING AND EVALUATION OF ELECTRIC WORK VEHICLES: JET 500, VOLKSWAGEN TYPE 2, DAUG TYPE GM2, AND BATTRONIC MINIVAN
R. K. McCluskey and J. L. Arias Dec. 1979 91 p
(EPRI Proj. 1136-1)
(EPRI-EM-1245) Avail: NTIS HC A05/MF A01

During the first 11 months of the EPRI/SCE Electric Vehicle Project, four electric vehicles (EVs) were tested and evaluated: the Jet Industries Electra-Van Model 500, the Volkswagen (VW) Type 2 Electrotransporter, a VW Type GM2 Transporter with DAUG electric drive, and the Battronic Minivan. The project emphasized road testing of these vehicles to acquire data on their useful driving range, performance, and reliability. Each vehicle was driven more than 1000 miles along SCE-selected test routes to determine the effects of different terrains (level, slight grades, and steep grades), traffic conditions (one, two, three, and four stops/mile and freeway), and payload. The vehicle component failures that occurred during testing are itemized and described briefly, and assessments of expected field reliability are made. Other vehicle characteristics and measurements of interest are presented. The data base on these test vehicles is intended to provide the reader an overview of the real world performance that can be expected from present day state-of-the-art EVs.DOE

N80-28657# California Univ., Livermore. Lawrence Livermore Lab.
ELECTROMAGNETIC PROPULSION: DRAG AND EROSION MODELING
A. C. Buckingham 25 Apr. 1980 10 p refs Presented at 16th AIAA-SAE-ASME Joint Propulsion Conf., Hartford, Conn., 30 Jun. - 2 Jul. 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83721; CONF-800620-1) Avail: NTIS HC A02/MF A01

The history of candidate projectile material response is traced sequentially from start of motion. The analysis includes sliding friction with projectile deformation, followed, where appropriate, by liquid metal and multiphase erosive viscous interface layer development, heat, mass, and momentum transport, and subsequent launch ballistics calculations incorporating the influence of these physical considerations. Several preferred candidate materials and sabot/projectile configurations emerge from these computational studies. DOE

N80-28658# Fondazione Ugo Bordoni, Rome (Italy).
DESIGN OF DIRECTIONAL COUPLERS BETWEEN DIFFERENT OPEN STRUCTURES [PROGETTO DI ACCOPPIATORI DIREZIONALI TRA STRUTTURE APERTE DIFFERENTI]
Franco Bertolani, Gabriele Falciasecca (Bologne Univ.), and Daniele Zambelli (Bologne Univ.) Dec. 1978 29 p refs In ITALIAN
(FUB-42-1978) Avail: NTIS HC A03/MF A01

The electromagnetic coupling between millimeter waves travelling through waveguides by means of openings in the metallic wall separating both guides, was studied. The effect of the opening on the configuration of the field of each guide was also investigated. A mathematical model was developed for the design of directional couplers between different structures and the corresponding computer program. Author (ESA)

N80-28659# Atomic Weapons Research Establishment, Aldermaston (England).
A QUICK METHOD FOR CALCULATING TEMPERATURES ARISING FROM EXTENDED MICROCIRCUIT HEAT SOURCES
D. J. Dean London HMSO Jan. 1980 27 p refs
(AWRE-O-42/79; BR72025) Avail: NTIS HC A03/MF A01; HMSO, London 1 PHI

A series summation computation method is presented, suitable for pocket calculators, by which the state of convergence (SOC), in terms of maximum possible error, is calculated at each stage in the summation, thus enabling the calculation to be terminated as soon as the required accuracy has been obtained. An application is shown in thermal design. Author (ESA)

N80-28660# National Technical Information Service, Springfield, Va.
PHASE SHIFTERS. CITATIONS FROM THE NTIS DATA BASE Progress Report, Jun. 1977 - Apr. 1980
William E. Reed May 1980 208 p Supersedes NTIS/PS-79/0492; NTIS/PS-78/0470
(PB80-810062; NTIS/PS-79/0492; NTIS/PS-78/0470) Avail: NTIS HC $30.00/MF $30.00 CSCL 09C

The bibliography cites Federally-funded research on the design, performance, and utilization of phase shifters and phase shift circuits. The types include ferrite, semiconductor, digital, and voltage controlled. Applications cover phased arrays, microwave equipment, surface acoustic wave devices, strip transmission lines, phases shift keyers, signal processors, and control equipment. This updated bibliography contains 20 abstracts. GRA

N80-28661# National Technical Information Service, Springfield, Va.
PHASE SHIFTERS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1973 - 1977
William E. Reed May 1980 228 p
(PB80-810070) Avail: NTIS HC $30.00/MF $30.00 CSCL 09C

The bibliography cites worldwide research on the design, performance, and utilization of phase shift circuits. Citations cover

ferrite, semiconductor, digital, and voltage controlled shifters. The applications include phased arrays, microwave equipment, surface acoustic wave devices, strip transmission lines, phase shift keyers, signal processors, and control equipment. This updated bibliography contains 221 abstracts, none of which are new entries to the previous edition. GRA

N80-28662# National Technical Information Service, Springfield, Va.
PHASE SHIFTERS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Apr. 1980
William E. Reed May 1980 102 p Supersedes NTIS/PS-79/0493; NTIS/PS-78/0471
(PB80-810088; NTIS/PS-79/0493; NTIS/PS-78/0471) Avail: NTIS HC $30.00/MF $30.00 CSCL 09C

The bibliography cites worldwide research on the design, performance, and utilization of phase shifters and phase shift circuits. Citations cover ferrite, semiconductor, digital, and voltage controlled shifters. The applications include phase arrays, microwave equipment, surface acoustic wave devices, strip transmission lines, phase shift keyers, signal processors, and control equipment. This updated bibliography contains 95 abstracts, 39 of which are new entries to the previous edition. GRA

N80-28663# National Bureau of Standards, Washington, D.C. National Engineering Lab.
CHARACTERIZATION OF ELECTRICALLY SMALL RADIATING SOURCES BY TESTS INSIDE A TRANSMISSION LINE CELL
Ippalapalli Sreenivasiah, David C. Chang, and Mark T. Ma Feb. 1980 71 p refs Prepared in cooperation with Colorado Univ., Boulder
(PB80-169931; NBS-TN-1017) Avail: NTIS HC A04/MF A01 CSCL 09E

An electrically small radiating source of arbitrary nature may be modeled by an equivalent dipole system consisting of three orthogonal electric dipoles and three orthogonal magnetic dipoles, each excited with arbitrary phase. An experimental procedure for determining the emission characteristics of such an equivalent dipole system by tests inside a single mode transmission line cell is described. Some experimental results are presented. GRA

N80-28664# National Technical Information Service, Springfield, Va.
BAND PASS FILTERS. CITATIONS FROM THE NTIS DATA BASE Progress Report, Feb. 1977 - Apr. 1980
William E. Reed Apr. 1980 249 p Supersedes NTIS/PS-79/0300 and NTIS/PS-78/0215
(PB80-809676; NTIS/PS-79/0300; NTIS/PS-78/0215) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

A bibliography containing 242 abstracts addressing the design, fabrication, characterization, and application of band pass filters is presented. Radiofrequency, digital, acoustic surface wave, and X-ray filters are included. GRA

N80-28665# National Technical Information Service, Springfield, Va.
BAND PASS FILTERS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Feb. 1980
William E. Reed Apr. 1980 241 p Supersedes NTIS/PS-79/0302; NTIS/PS-78/0216
(PB80-809684; NTIS/PS-79/0302; NTIS/PS-78/0216) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The bibliography cites worldwide research on the design, fabrication, characterization, and application of band pass filters. Radiofrequency, electric, digital, and acoustic surface wave filters are included. Optical filters are excluded. This updated bibliography contains 234 abstracts, 102 of which are new entries to the previous edition. GRA

N80-28666# National Technical Information Service, Springfield, Va.
BEAM LEAD MICROELECTRONICS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1980
William E. Reed Apr. 1980 94 p Supersedes NTIS/PS-79/0389 and NTIS/PS-78/0368
(PB80-808348; NTIS/PS-79/0389; NTIS/PS-78/0368) Avail: NTIS HC $30.00/MF $30.00 CSCL 09E

The technology and application of beam lead devices are treated in these Federally-sponsored research reports. Topics include design, fabrication, bonding, packaging, testing, and radiation hardening. This updated bibliography contains 85 abstracts, 4 of which are new entries to the previous edition. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-28667# Defence Research Establishment Suffield, Ralston (Alberta).
DIE SWELL FOR NEWTONIAN FLUIDS
C. L. Chenier and G. A. Hill May 1980 28 p refs
(AD-A085199; DRES-TN-477) Avail: NTIS HC A03/MF A01 CSCL 20/8

The swelling and shrinking of Newtonian jets issuing from circular orifices or slits has been examined. Equations predicting die swell ratio and downstream flow characteristics are developed. The scatter of experimental data has been studied and the factors contributing to this phenomenon are presented. The die swell ratios and jet shapes versus Reynolds numbers for Newtonian liquids are empirically shown. GRA

N80-28668# Princeton Univ., N. J. Dept. of Mechanical and Aerospace Engineering.
EXPERIMENTAL INVESTIGATION OF THREE-DIMENSIONAL SHOCK WAVE TURBULENT BOUNDARY LAYER INTERACTION: AN EXPLORATORY STUDY OF BLUNT FIN-INDUCED FLOWS Final Report, Jun. 1976 - Dec. 1979
David S. Dolling and Seymour M. Bogdonoff Mar. 1980 75 p refs
(Grants DAAG29-76-G-0269; DAAG29-78-G-0140)
(AD-A084768; MAE-1468; ARO-14026.2-EX) Avail: NTIS HC A04/MF A01 CSCL 20/4

An experimental study of three dimensional (3 D) shock wave turbulent boundary layer interaction has been carried out. Interactions generated by fin models having sharp and hemi-cylindrically blunted leading edges have been studied. The emphasis in this particular study was twofold. First, the influence of incoming turbulent boundary layer thickness delta on the streamwise, spanwise and vertical scaling of the interaction was examined. Turbulent boundary layers varying in thickness from .127 cm (.05 in.) to 2.27 cm (0.89 in.) were used. In addition, a study has been conducted to examine the effects of the ratio D/delta (where D is the blunt fin leading edge diameter) on the interaction properties and scaling. Second, an investigation has been started to examine the unsteady shock wave-boundary layer structure and the resulting high frequency, large amplitude pressure fluctuations which occur ahead of and around the blunt fin leading edge. This is an area which in the past has been largely ignored, yet has important implications, since it is not clear that any mean surface property or flowfield measurements have any real physical significance. To date, measurement techniques and computer software have been developed and exploratory measurements made in the undisturbed turbulent boundary layer and also on the plane of symmetry ahead of the blunt fin. GRA

N80-28669# ARO, Inc., Arnold Air Force Station, Tenn.
ANALYSIS OF THE FLOW INTERACTIONS BETWEEN LARGE WATER DROPLETS AND AIR IN DROPLET ACCELERATION NOZZLES Final Report, Oct. 1978 - Sep. 1979
P. A. Kessel AEDC May 1980 46 p refs
(AD-A085114; AEDC-TR-79-97) Avail: NTIS HC A03/MF A01 CSCL 20/4

The conditions under which large drops, on the order of

150 micron in diameter, are formed from high velocity liquid jets and their subsequent behavior in high velocity airstreams are discussed. The quasi-one dimensional equations for fully coupled two phase turbulent flow of a noncondensable gas with evaporating droplets in a convergent-divergent nozzle are formulated. Droplet performance predictions for the Dust Erosion Tunnel (DET) are reviewed in the light of existing two phase flow test data. Criteria for the aerodynamic design of a droplet acceleration nozzle that would inhibit droplet breakup are developed and used for studying the performance of a droplet acceleration nozzle in the AEDC High Enthalpy Arc Tunnel (HEAT) test facility (H-1) and the DET facility. The conclusion is that although acceleration of large drops without breakup is feasible, many problems will have to be solved to obtain high droplet velocities with large droplets. GRA

N80-28670# Ballistic Research Labs., Aberdeen Proving Ground, Md.

A PRELIMINARY INVESTIGATION OF THE SINGULAR BEHAVIOR OF FLUIDS NEAR A SLIDING CORNER Final Report

Patrick J. Roache and Csaba K. Zoltani Mar. 1980 18 p refs (DA Proj. 1L1-61102-AH-43)
(AD-A084983; AD-E430433; ARBRL-TR-02226) Avail: NTIS HC A02/MF A01 CSCL 20/4

This paper describes the application of a semidirect method to the calculation of the flow near a sliding corner. On a set of successively refined grids the Navier-Stokes equations modeling the steady state viscous, incompressible, low Reynolds number flow are solved in terms of the vorticity and stream function in Cartesian coordinates for a slab geometry. The calculated flow field allows preliminary estimates of the nature of the flow at the sliding corner. GRA

N80-28671# Pennsylvania State Univ., University Park. Applied Research Lab.

TRANSITION NOISE: THE ROLE OF FLUCTUATING DISPLACEMENT THICKNESS

G. C. Lauchle 27 Mar. 1980 39 p refs
(Contract N00024-79-C-6043)
(AD-A085103; ARL/PSU-TM-80-41) Avail: NTIS HC A03/MF A01 CSCL 20/4

The role of the fluctuating wall shear stress on the noise generated by incompressible boundary-layer transition was recently analyzed. The solutions of that analysis suggest that the shear stress mechanism generates hydrodynamic sound weakly in comparison say to the sound generated by a fully developed turbulent boundary layer flow. Because boundary-layer transition is a very unstable and non-steady flow, it is expected that other acoustic mechanisms exist. This paper examines one other; namely, that of the fluctuating boundary layer displacement thickness which is expected to occur as turbulent bursts are created and convected over the surface. The analysis shows that a weak monopole sound source occurs, and at low subsonic flow velocities, this source generates significant acoustic energy. Comparisons of the theoretical predictions with available experimental data support this conclusion. GRA

N80-28672# Pennsylvania State Univ., University Park. Applied Research Lab.

NONLINEAR ACOUSTIC WAVE INTERACTIONS IN LAYERED MEDIA M.S. Thesis

David Marvin Yeager 6 Mar. 1980 109 p refs
(Contract N00024-79-C-6043)
(AD-A085185; TM-80-32) Avail: NTIS HC A06/MF A01 CSCL 20/1

The conversion efficiency of parametric amplification in fluids is low because of the low dispersivity. A discontinuous change in phase velocity at the boundary of a waveguide introduces dispersion, which in turn affects conversion efficiency. It is the purpose of this thesis to develop from first principles an analytical model which may be used to numerically predict the conversion efficiency of a flat-plate, acoustic waveguide given the physical parameters of the system. In order to quantify weak, finite-amplitude interactions in the guide, the linear behavior of the system must first be analyzed. This is accomplished using Green's functions. Once the linear characteristics have been determined, nonlinear phenomena are investigated; both analytically and numerically via digital computer graphics. The physical parameters in the numerical examples were chosen to correspond with materials used in previously published experimental work using cylinders rather than flat plates. GRA

N80-28673# Air Force Academy, Colo. Research Lab.

AN INVESTIGATION OF UNSTEADY FLOW SEPARATION Final Report, Sep. 1975 - Sep. 1979

M. S. Francis, J. E. Keesee, J. P. Retelle, G. E. Sisson, and J. D. Lang Mar. 1980 91 p refs
(AF Proj. 2307)
(AD-A085083; SRL-TR-80-0009) Avail: NTIS HC A05/MF A01 CSCL 20/4

The results of experiments in which an unsteady flow was generated on the surface of an airfoil immersed in an incompressible freestream are discussed. Measurements of the velocity and vorticity fields and the surface pressure distribution generated by oscillations of a fence-type spoiler located on one surface of the airfoil has confirmed the presence of a dynamically evolving vortex-like structure bearing a close resemblance to the one encountered in classical dynamic stall. The growth and development of the shear layer region is characterized through iso-vorticity contour maps at select phase points during the motion cycle. A detailed description of flow field behavior is provided over a range of dimensionless spoiler frequencies and freestream Reynolds numbers. The correlation of these results with corresponding surface pressure measurements is also presented. GRA

N80-28674# California Univ., Livermore. Lawrence Livermore Lab.

FEM SOLUTION OF THE NAVIER-STOKES EQUATIONS FOR VORTEX SHEDDING

Philip M. Gresho, Robert L. Lee, and Craig D. Upson Jan. 1980 18 p refs Presented at 3d Intern. Conf. on Finite Elements in Water Resources, Oxford, Miss., 19-23 May 1980 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-83925; CONF-800515-2) Avail: NTIS HC A02/MF A01

Results from three variations on a simple 4 node element (bilinear velocity and piecewise constant pressure) are compared with those from a higher order element (9 node biquadratic velocity and 4 node bilinear pressure) on the same problem and on the same grid. DOE

N80-28675# Battelle Pacific Northwest Labs., Richland, Wash.

VARIABLE THICKNESS TRANSIENT GROUND-WATER FLOW MODEL. VOLUME 3: PROGRAM LISTINGS

A. E. Reisenauer Dec. 1979 236 p
(Contract EY-76-C-06-1830)
(PNL-3160-3) Avail: NTIS HC A11/MF A01

The Assessment of Effectiveness of Geologic Isolation Systems (AEGIS) program is developing and applying the methodology for assessing the far-field, long term post closure safety of deep geologic nuclear waste repositories. AEGIS is being performed by Pacific Northwest Laboratory (PNL) under contract with the Office of Nuclear Waste Isolation (ONWI) for the Department of Energy (DOE). One task within AEGIS is the development of methodology for analysis of the consequences (water pathway) from loss of repository containment as defined by various release scenarios. Analysis of the long term, far-field consequences of release scenarios requires the application of numerical codes which simulate the hydrologic systems, model the transport of released radionuclides through the hydrologic systems to the biosphere, and, where applicable, assess the radiological dose to humans. Hydrologic and transport models are available at several levels of complexity or sophistication. Model selection and use are determined by the quantity and quality of input data. Model development under AEGIS and related programs provides three levels of hydrologic models, two levels of transport models, and one level of dose models (with several separate models). This is the third of 3 volumes of the description of the VTT (Variable Thickness Transient) Groundwater Hydrologic Model - second level (intermediate complexity) two dimensional saturated groundwater flow. DOE

N80-28676# California Univ., Livermore. Lawrence Livermore Lab.
DEVELOPMENT AND UTILIZATION OF A TWO-DIMENSIONAL MODEL OF TRANSIENT FLUID FLOW IN A GENERIC REPOSITORY (OGRE)
John A. Korver 10 Oct. 1979 61 p refs
(Contract W-7405-eng-48)
(UCID-18650) Avail: NTIS HC A04/MF A01

An existing time-dependent numerical model (OGRE) has been modified to examine the time frames associated with repressuring the formation rocks surrounding a generic nuclear waste repository following the operational period when wastes are being stored. The model is two dimensional in the vertical plane, and assumes that the entire regime is saturated, but the repository is at one atmosphere during the operational period. For the physical and geometric parameters assumed, the results of a simulation of the time necessary to repressurize the formation after the operational period was 421.5 years. These results were in close agreement with a steady-state calculation performed by Golder Associates, Inc., in 1977. The fact that the time-dependent model results were close to the steady-state calculation resulted from the use (in the model) of a very small compressibility value, which caused the simulation to reach a steady-state condition in a relatively short time. Based on these studies, the magnitude of the system (water plus matrix) compressibility is of great importance in determining whether the time for repressurization can be determined from analytical methods or requires the use of a time-dependent numerical model. DOE

N80-28677# California Univ., Livermore. Lawrence Livermore Lab.
TWO-DIMENSIONAL GAS FLOW IN AN ELECTRODE ASSEMBLY
Gordon W. Hamilton and G. W. Willmann 8 Apr. 1980 25 p refs
(Contract W-7405-eng-48)
(UCID-18568) Avail: NTIS HC A02/MF A01

The interface between a source of positive or negative ions and a multichannel MEQALAC accelerator is the low energy beam transport (LEBT) consisting of a lattice of quadrupole focusing electrodes transporting the beam while the gas pressure is reduced from the high pressure ion source to the low pressure accelerator. Gas emitted from the ion source flows through the LEBT electrode lattice to a pumping volume. The two dimensional gas flow is analyzed to ascertain the gas densities throughout the LEBT and to design the system so that only a small fraction of the ion beam is lost by gas collisions. The analysis uses the fact that the gas flow rate is proportional to the density gradient if the mean free path of the low pressure gas is greater than the interelectrode spacing. The practical result is to determine the maximum width of the LEBT so that the beam loss by gas collisions is tolerable. The maximum width is a function of beam density, gas efficiency, and electrode spacing. The beam current per unit length of module will be somewhat greater than 75 mA/cm. Electrode dimensions should be chosen to fit the characteristics of the ion source. DOE

N80-28678# Beet Sugar Development Foundation, Fort Collins, Colo.
EVAPORATION BY MECHANICAL VAPOR RECOMPRESSION Technical Progress Report, 1 Jan. - Apr. 1980
Clair H. Iverson and Glenn E. Coury 1980 87 p refs
(Contract DE-AC03-79CS-40208)
(BSDF-38-20-80) Avail: NTIS HC A05/MF A01

Progress in the development of a study of the application of the technologies of mechanical vapor recompression and falling film evaporation as applied to the beet sugar industry is reported. Progress is reported in the following areas: technical literature search; report on visit to European factories using these technologies; energy balance studies of factories offered by the industry as candidates for the demonstration plants; and report on energy balance studies and the recommendations as to the site for the demonstration plant. DOE

N80-28679# Scientific Translation Service, Santa Barbara, Calif.
POSSIBILITIES FOR THE DETERMINATION OF THE HEAT TRANSFER PROCESS BETWEEN NUCLEAR FUEL RODS AND THE COOLING MEDIUM IN A SODIUM-COOLED REACTOR DURING OPERATION
F. Mitzel Aug. 1979 52 p refs Transl. into ENGLISH of "Moglichkeiten zur Bestimmung des Warmeuberganges zwischen nuklearen Brennstaben und dem Kuhlmittel ineinem natriumgekuhlten Reaktor wahrend des Betriebes", rept. KFK 2619, Inst. fur Neutronenphysik und Reaktortechnik, Karlsruhe, W. Germany, Jun. 1978 45 p. Sponsored by DOE
(DOE-tr-142; KFK-2619) Avail: NTIS HC A03/MF A01

In order to improve the safety, the surveillance, and economy of sodium cooled reactors it is desirable to obtain a more precise knowledge of the heat transfer between the fuel and the coolant. Different possibilities were investigated to determine the corresponding heat transfer coefficient by measuring the pertinent transfer functions. The result was the following: the heat transfer coefficient can be determined with reasonable accuracy at the KNK 11 and the SNR by means of small pseudo-stochastic power oscillations. These power oscillations must be artificially induced but do not require an interruption of the normal plant operation. DOE

N80-28680# National Technical Information Service, Springfield, Va.
HEAT PIPES. CITATIONS FROM THE NTIS DATA BASE Progress Report, Mar. 1976 - Mar. 1979
William E. Reed Apr. 1980 254 p
(PB80-809940) Avail: NTIS HC $30.00/MF $30.00 CSCL 13A

Theory, design, fabrication, testing, and operation of heat pipes are presented in these Federally-sponsored research reports. Applications are described in the areas of heating and air conditioning, power generation, electronics cooling, spacecraft, nuclear reactors, cooling engines, and thermodynamics. This updated bibliography contains 247 abstracts, none of which are new entries to the previous edition. GRA

N80-28681# National Technical Information Service, Springfield, Va.
HEAT PIPES. CITATIONS FROM THE NTIS DATA BASE Progress Report, Apr. 1979 - Apr. 1980
William E. Reed Apr. 1980 77 p Supersedes NTIS/PS-79/0298; NTIS/PS-78/0302
(PB80-809957; NTIS/PS-79/0298; NTIS/PS-78/0302) Avail: NTIS HC $30.00/MF $30.00 CSCL 13A

Theory, design, fabrication, testing, and operation of heat pipes are presented in these Federally sponsored research reports. Applications are described in the areas of heating and air conditioning, power generation, electronics cooling, spacecraft, nuclear reactors, cooling engines, and thermodynamics. This updated bibliography contains 70 abstracts, all of which are new entries to the previous edition. GRA

N80-28682# National Technical Information Service, Springfield, Va.
HEAT PIPES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. 1977 - Mar. 1979
William E. Reed Apr. 1980 215 p
(PB80-809965) Avail: NTIS HC $30.00/MF $30.00 CSCL 13A

Research reports covering the thermodynamics, design, fabrication, and applications of heat pipes are cited from worldwide literature. Applications are described in the areas of electronics cooling, spacecraft thermal control, heat exchangers, heating and refrigeration, and waste heat utilization. This updated bibliography contains 208 abstracts, none of which are new entries to the previous edition. GRA

N80-28683# National Technical Information Service, Springfield, Va.
HEAT PIPES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, Apr. 1979 - Mar. 1980
William E. Reed Apr. 1980 132 p Supersedes NTIS/PS/0299; NTIS/PS-78/0304
(PB80-809973; NTIS/PS-79/0299; NTIS/PS-78/0304) Avail: NTIS HC $30.00/MF $30.00 CSCL 13A

Research reports covering the thermodynamics, design, fabrication, and applications of heat pipes are cited from worldwide literature. Applications are described in the areas of electronics cooling, spacecraft thermal control, heat exchangers, heating and

refrigeration, and waste heat utilization. This updated bibliography contains 125 abstracts, all of which are new entries to the previous edition. GRA

N80-28684# National Technical Information Service, Springfield, Va.
CAVITY FLOW. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1971 - Mar. 1980
Guy E. Habercom, Jr. May 1980 267 p Supersedes NTIS/PS-79/0259; NTIS/PS-78/0188 (PB80-810146; NTIS/PS-79-0259; NTIS/PS-78/0188) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

Reports are cited on shallow and deep configurations, holes, cutouts, hollows, notches, gaps, orifices, flaps, and steps. Applications include bomb bays, aerodynamic windows, microwave cavities, resonators, diffusers, laser cavities, and jets. This updated bibliography contains 260 abstracts, 29 of which are new entries to the previous edition. GRA

N80-28685# National Technical Information Service, Springfield, Va.
FLOW VISUALIZATION. CITATIONS FROM THE NTIS DATA BASE Progress Report, Apr. 1977 - Mar. 1980
Guy E. Habercom, Jr. Apr. 1980 208 p Supersedes NTIS/PS-79/0480; NTIS/PS-78/0426 (PB80-809577; NTIS/PS-79/0480; NTIS/PS-78/0426) Avail: NTIS HC $30.00/MF $30.00 CSCL 20D

Major studies concerning flow visualization for wind tunnel, water tunnel, and shock tube testing are cited. The visualization methods described include the use of smoke, water vapor, dyes, oils, bubbles, phase change paints, and particles. While many of these studies cover flow visualization techniques for specific applications, they are included because of their applicability to various research problems. This updated bibliography contains 202 abstracts, 63 of which are new entries to the previous edition. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-28686* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DUAL ACTING SLIT CONTROL MECHANISM Patent
Gustav L. Struthoff, inventor (to NASA) (Rensselaer Polytechnic Inst.) Issued 15 Jul. 1980 4 p Filed 8 Sep. 1978 Supersedes N78-32399 (16 - 23, p 3081) Sponsored by NASA (NASA-Case-LAR-11370-1; US-Patent-4,213,051; US-Patent-Appl-SN-940689; US-Patent-Class-250-457; US-Patent-Class-250-491; US-Patent-Class-250-513) Avail: US Patent and Trademark Office CSCL 14B

A dual acting control system for mass spectrometers is described, which permits adjustment of the collimating slit width and centering of the collimating slit while using only one vacuum penetration. Coaxial shafts, each with independent vacuum bellows are used to independently move the entire collimating assembly or to adjust the slit dimension through a parallelogram linkage.
Official Gazette of the U.S. Patent and Trademark Office

N80-28687* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VISIBLE AND INFRARED POLARIZATION RATIO SPECTROREFLECTOMETER Patent
Carmen E. Batten, inventor (to NASA) Issued 1 Jul. 1980 11 p Filed 28 Jul. 1978 Supersedes N78-32398 (16 - 24, p 3179) (NASA-Case-LAR-12285-1; US-Patent-4,210,401; US-Patent-Appl-SN-929087; US-Patent-Class-356-369; US-Patent-Class-356-244) Avail: US Patent and Trademark Office CSCL 14B

The instrument assists in determining the refractive index and absorption index, at different spectral frequencies, of a solid sample by illuminating the sample at various angles in incidence and measuring the corresponding reflected intensities at various spectral frequencies and polarization angles. The ratio of the intensity of the reflected light for parallel polarized light to that for perpendicular polarized light at two different angles of incidence can be used to determine the optical constants of the sample. The invention involves an apparatus for facilitating the utilization of a wide variety of angles of incidence. The light source and polarizing element are positioned on an outer platform; the sample is positioned on an inner platform. The two platforms rotate about a common axis and cooperate in their rotation such that the sample is rotated one degree for every two degrees of rotation of the light source. This maintains the impingement of the reflected light upon the detector for any angle of incidence without moving or adjusting the detector which allows a continuous change in the angle of incidence.
Official Gazette of the U.S. Patent and Trademark Office

N80-28688 Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
DEVELOPMENT OF AN ELECTROMAGNETIC PARTICLE ACCELERATOR [ENTWICKLUNG EINES ELEKTROMAGNETISCHEN TEILCHENBESCHLEUNIGERS]
P. Lell and H. Kuczera Jun. 1978 16 p refs In GERMAN (TUM-RT-KB-78/2) Avail: Issuing Activity

The electromagnetic accelerator works for the speeds up to several hundred. With the aid of a driver, particles in the range of 10 to the minus 6th power were accelerated up to few millimeters. The tests show high accuracy and reliability. This accelerator can work in high vacuum (free of impurities) because it does not need a gaseous medium for the transfer of the energy to the particle. Automation of the driver and of the particle transport is possible, and a computer simulation is described.
Author (ESA)

N80-28689*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
PROCUREMENT SPECIFICATION COLOR GRAPHIC CAMERA SYSTEM
G. E. Prow Jun. 1980 12 p
(Contract NAS9-15800)
(NASA-CR-160763; JSC-16738; LEMSCO-15122) Avail: NTIS HC A02/MF A01 CSCL 14E

The performance and design requirements for a Color Graphic Camera System are presented. The system is a functional part of the Earth Observation Department Laboratory System (EODLS) and will be interfaced with Image Analysis Stations. It will convert the output of a raster scan computer color terminal into permanent, high resolution photographic prints and transparencies. Images usually displayed will be remotely sensed LANDSAT imager scenes. L.F.M.

N80-28690*# Utah Univ., Salt Lake City. Geospace Sciences Lab.
FIBER RING OPTICAL GYROSCOPE (FROG) Final Report
31 Dec. 1979 62 p refs
(Contracts NAS7-100; JPL-954936)
(NASA-CR-163387; Publ-79-014) Avail: NTIS HC A04/MF A01 CSCL 14B

The design, construction, and testing of a one meter diameter fiber ring optical gyro, using 1.57 kilometers of single mode fiber, are described. The various noise components: electronic, thermal, mechanical, and optical, were evaluated. Both dc and ac methods were used. An attempt was made to measure the Earth rotation rate; however, the results were questionable because of the optical and electronic noise present. It was concluded that fiber ring optical gyroscopes using all discrete components have many serious problems that can only be overcome by discarding the discrete approach and adapting an all integrated optic technique that has the laser source, modulator, detector, beamsplitters, and bias element on a single chip. L.F.M.

N80-28691# Pacific Missile Test Center, Point Mugu, Calif. Weapons Instrumentation Div.

UNRECORDED WIDEBAND INSTRUMENTATION REFERENCE TAPE FEASIBILITY STUDY: FREQUENCY RESPONSE RESULTS

D. R. Hust 26 Mar. 1980 68 p
(W08040000)
(AD-A084102; PMTC-TP-80-05) Avail: NTIS HC A04/MF A01 CSCL 14/3

An investigation was conducted to determine signal response variations when a variety of wideband instrumentation magnetic tapes is used on a cross section of recorder/reproducer systems. Data for the investigation were collected by transmitting a set of eight sample test tapes to participating data recording/reproducing facilities for the purpose of making data measurements. Data collected represent measurements made with 16 different recorder/reproducer systems at 11 different testing facilities located throughout the United States. The data-collection process involved approximately 2 years of testing. The originating/coordinating facility was the Pacific Missile Test Center, Point Mugu, California. The test results indicated the following: all of the sample test tapes exhibited bidirectional performance within the limits of measurement repeatability; overall system stability was better in the low-band regions than in the upper-band regions; and the overall relative frequency response of the sample test tapes did not change appreciably during the 2 year investigative period. The most significant result of the test measurements is that at least 90% of the frequency response values were within + or - 2.0 dB at all frequencies. Machine stability factors such as azimuth, equalizer, and gain changes had more effect on data variability than did magnetic tape or tape speed. The use of a reference tape system is recommended as a method to assure that relative frequency response variations will be less than or equal to + or - 2.0 dB. GRA

N80-28692# ARO, Inc., Arnold Air Force Station, Tenn.

ELECTRO-OPTICAL PRESSURE-MEASUREMENT TECHNIQUES Final Report, 1 Oct. 1978 - 30 Sep. 1979

H. T. Bentley, III and P. J. Murphy AEDC May 1980 40 p refs
(AD-A084697; AEDC-TR-79-92) Avail: NTIS HC A03/MF A01 CSCL 14/2

An investigation of the potential application of electrooptical techniques for the measurement of surface pressure distributions was conducted, and several candidate methods were reviewed. The most promising technique utilizes the optical and mechanical properties of a reflective circular membrane. The characteristics of an ideal membrane are analyzed with respect to membrane tension, static pressure, and dynamic membrance response. GRA

N80-28693# Accumetrics Corp., Cambridge, Mass.

APPLIED RESEARCH AND DEVELOPMENT OF TRIAXIAL PIEZOELECTRIC (PZL) ACCELEROMETER SYSTEMS OF IMPROVED DESIGN Final Report, Mar. 1977 - Jun. 1979

Donald H. Frykiund Hanscom AFB, Mass. AFGL Jun. 1979 41 p
(Contract F19628-77-C-0163)
(AD-A084762; AFGL-TR-79-0101) Avail: NTIS HC A03/MF A01 CSCL 14/2

Refinements in the accelerometer system used in the falling-sphere atmospheric density measuring system have been implemented. These include a redesigned Z-axis amplifier chain, range scale changes in the X and y axis amplifier outputs to provide overlap, and a new temperature monitor circuit. The squib initiation circuit and squib holder bushing has been redesigned for greater reliability. Calibration has been improved by the use of a specially-designed function generator. Five systems were fabricated. Three systems were flown at Kwajalein, M.I. and Red Lake, Canada. GRA

N80-28694# Environmental Research Inst. of Michigan, Ann Arbor. Radar and Optics Div.

COMPUTER GENERATED HOLOGRAPHIC OPTICS Final Report, 1 Apr. 1977 - 31 Mar. 1980

James R. Fienup May 1980 24 p refs
(Contract DAAG29-77-C-0017)
(AD-A085219; ERIN-128600-12-F; ARO-14582.2-EL) Avail: NTIS HC A02/MF A01 CSCL 20/6

The goal of this research was to theoretically and experimentally investigate the use of computer-generated holograms in the design and fabrication of holographic optical elements (holographic lenses or diffraction optics). Conventional design of holographic lenses had previously been limited to spherical recording beams, and more recently to recording beams formed by conventional optical systems. The utilization of computer-generated holograms in the recording beams allows a completely arbitrary specification of the recording wavefronts in the hologram plane, making possible a hologram lens of higher performance (lower aberrations) than previously possible. We refer to an interferometrically recorded hologram lens having a computer-generated hologram in a recording beam as a computer-originated holographic lens. We studied the basic limitations of computer-generated holograms, and integrated the analysis of computer-generated holograms and computer-originated holographic optical elements into ERIM:s holographic optical analysis and design (HOAD) ray-tracing computer program. In addition, we designed, fabricated, and tested an optical system using a computer-generated hologram and a computer-originated holographic lens. GRA

N80-28695# New Mexico Univ., Albuquerque. Bureau of Engineering Research.

THE CALIBRATION OF SOLAR RADIATION MEASURING INSTRUMENTS Final Report

Raymond J. Bahn and John C. Nakos Nov. 1979 237 p refs
(Contract EM-78-S-04-5336)
(ALO-5336-T1) Avail: NTIS HC A11/MF A01

A review of solar radiation measurement of instruments and some types of errors is given; and procedures for calibrating solar radiation measuring instruments are detailed. An appendix contains a description of various agencies who perform calibration of solar instruments and a description of the methods they used at the time this report was prepared. DOE

N80-28696# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho. Loft Experimental Measurements Branch.

EVALUATION OF INSTALLED INSTRUMENTATION FOR LIQUID LEVEL MEASUREMENTS

J. P. Adams, V. E. Flitton, and L. D. Goodrich 20 Dec. 1979 53 p refs
(Contract EY-76-C-07-1570)
(EGG/LTR-LO-87-79-128; USNRC-P-394) Avail: NTIS HC A04/MF A01

An evaluation is presented of the capability of several installed LOFT instruments to measure liquid level. This evaluation was accomplished by comparing thermocouples, neutron detectors, and differential pressure transducers with the LOFT liquid level transducers. A brief discussion of a heated differential thermocouple liquid level transducer is also presented. DOE

N80-28697# National Physical Lab., Teddington (England). Div. of Electrical Science.

A SLOW SCAN INTERFEROMETER FOR THE MIDDLE INFRARED REGION 4000-400 cm-1

J. W. Fleming and J. H. King Aug. 1979 25 p refs
(NPL-DES-56) Avail: NTIS HC A02/MF A01

The development of a slow scan mid-IR interferometric spectrometer covering the region .00025 to .0015 cm is described. Presently, the system has demonstrated a resolution of 1 cm, but it is hoped to improve this by a factor of 10 at a later stage. Factors limiting the performance of the spectrometer are analyzed, and the next stages required to improve resolution and performance are discussed. Author (ESA)

N80-28698# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.

DEVELOPMENT OF AN ELECTROMAGNETIC ACCELERATOR

P. Lell, H. Kuczera, and E. Igenbergs Aug. 1978 14 p refs
(TUM-LRT-KB-78/6) Avail: NTIS HC A02/MF A01

A hypervelocity launcher is described which can accelerate projectiles with diameters between 0.1 and 1 mm to velocities in the range of 20 km/s. This launcher was developed to simulate micrometeorid impact; and consists of a coaxial accelerator and a compressor coil. The positive side of a capacitor bank is connected to the center electrode, which is separated by an insulating plug from the annular electrode. After the discharge switch is activated, an aluminium foil evaporates and generates

an aluminium plasma. The discharge current density from the center electrode to the annular electrode interacts with the azimuthal magnetic field around the center electrode and accelerates the plasma axially. After the plasma has entered the compressor coil, a discharge between the center electrode tip and the compressor coil builds up. The current in the compressor coil generates a magnetic field, which interacts with the plasma flow. This results in a compression and an axial acceleration of the plasma in the compressor coil. Author (ESA)

N80-29599# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
CRYOGENIC SYSTEM OF THE 390 kg GRAVITATIONAL DETECTOR
U. Giovanardi, V. Iafolla, I. Modena (Rome Univ.), P. Napoleoni, B. Pavan, F. Ricci (Rome Univ.), and S. Ugazio Jul. 1979 15 p refs
(LPS-79-6) Avail: NTIS HC A02/MF A01

The basic operating principles of a Weber type gravitational antenna are briefly described, along with the problems of developing a continuously operating cryogenic cooling system. The aluminum bar antenna with a piezoelectric ceramic transducer are maintained at liquid helium temperature. Author (ESA)

N80-28700# National Technical Information Service, Springfield, Va.
SCHLIEREN AND SHADOWGRAPH PHOTOGRAPHY: FLOW VISUALIZATION AND MEASUREMENT. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Mar. 1980
Guy E. Habercom, Jr. Apr. 1980 251 p Supersedes NTIS/PS-79/0503; NTIS/PS-78/0412
(PB80-809783; NTIS/PS-79/0503; NTIS/PS-78/0412) Avail: NTIS HC $30.00/MF $30.00 CSCL 14E

Worldwide engineering research of Schlieren and shadowgraph photography techniques for flow measurement and visualization is presented. Included are studies on flames, combustion, and aerodynamic configurations. This updated bibliography contains 244 abstracts, 23 of which are new entries to the previous edition. GRA

N80-28701# National Technical Information Service, Springfield, Va.
SCHLIEREN AND SHADOWGRAPH PHOTOGRAPHY: GENERAL STUDIES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Mar. 1980
Guy E. Habercom, Jr. Apr. 1980 150 p Supersedes NTIS/PS-79/0505; NTIS/PS-78/0413
(PB80-809791; NTIS/PS-79-0505; NTIS/PS-78/0413) Avail: NTIS HC $30.00/MF $30.00 CSCL 14E

Aspects of Schlieren and shadowgraph photography are covered in this bibliography of worldwide engineering research. Techniques, equipment, and applications are reviewed for studying shock waves, combustion, acoustic waves, ballistics, and heat flow. This updated bibliography contains 143 abstracts, 24 of which are new entries to the previous edition. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-28702# Cornell Univ., Ithaca, N. Y. School of Applied and Engineering Physics.
CHEMICAL LASER SYSTEMS. Final Report, 1 Apr. 1977 - 31 Mar. 1979
Terrill A. Cool 31 Mar. 1979 106 p refs Submitted for publication
(Grant AF-AFOSR-3258-77; AF Proj. 2303)
(AD-A085264; AFOSR-80-0423TR) Avail: NTIS HC A06/MF A01 CSCL 20/5

The major effort undertaken was a thorough spectroscopic study of the products of reactions of yttrium and scandium atoms with halogen molecules. These studies have shown that chemiluminescence for these reaction systems does not originate from electronically excited monohalide molecules as suggested by previous investigators, but instead arises from electronically excited metal dihalide molecules, MX_2^*. Excitation spectra from the monohalides of yttrium and scandium were recorded with the laser-induced fluorescence method. Spectroscopic constants and radiative lifetimes were determined for several previously unobserved electronic states. An evaluation of the chemiluminescence from chemical reactions initiated in PH3/N2O mixtures was performed. GRA

N80-28703# Naval Postgraduate School, Monterey, Calif.
A MODEL FOR LASER PRODUCED MATERIALS SURFACE EVAPORATION M.S. Thesis
Geoffrey Lance Travers Mar. 1980 72 p refs
(AD-A084903) Avail: NTIS HC A04/MF A01 CSCL 20/5

This study is to assess the feasibility of using a laser's radiation to remove masses on the order of milligrams from a target surface and to form a vapor jet which could then serve as the conducting channel in a giant power pulse discharge. A model based on an energy balance is presented which predicts the mass removed and the pressure, density and temperature of the material as it propagates from the target surface as functions of the pulse time and the absorbed power density. Combinations of laser pulse time and power density are considered for which the surface temperature remains low enough in order to avoid cut-off by a plasma plume in front of the target surface. A model of adiabatic jet expansion is presented to predict the radial expansion of the vapor plume as it propagates in the axial direction. Temperature, pressure and density are predicted after radial expansion using the model of adiabatic jet expansion. These models predict, theoretically, that the desired masses and limits on vapor plume expansion can be achieved using relatively low power densities for the proposed experiment. GRA

N80-28704# Naval Postgraduate School, Monterey, Calif. Dept. of Aeronautics.
AERO-OPTICS AT SHORTER WAVELENGTHS Progress Report, Dec. 1979 - Mar. 1980
Allen E. Fuhs Mar. 1980 30 p refs Presented at the Flow Control Workshop, Kirtland AFB, N. Mex., 10-12 Mar. 1980
(Contract AFOSR MIPR-80-MP-084)
(AD-A085104; NPS67-80-003) Avail: NTIS HC A03/MF A01 CSCL 20/5

Using the optical system equation, the impact of a change in wavelength is determined. The rms phase variation at output aperture is critical and must be reduced by an amount equivalent to reduction in wavelength. If turret size is scaled with wavelength, the distortion due to the inviscid flow remains constant. Decreased wavelength offers the flexibility of greatly reduced turret weight, volume, and aerodynamic drag. Multiple turrets become feasible on an aircraft. The distortion due to the turbulent boundary layer becomes magnified by reduction of wavelength; however, if the turbulent boundary layer originates on the turret and if the turret is scaled, the boundary layer thickness decreases. Distortion becomes less significant in this case. GRA

N80-28705# University of Southern California, Los Angeles. Dept. of Chemistry.
THE CASE OF TWO REACTIVE AND INTERCOMMUNICATING EXCITED STATES
Arthur W. Adamson, Robert C. Kukuda, and R. Tom Walters May 1980 27 p refs
(Contract N00014-76-C-0548)
(AD-A084978; TR-11) Avail: NTIS HC A03/MF A01 CSCL 07/4

The exact kinetics of a pulsed laser experiment producing two potentially reactive and potentially intercommunicative states is examined in detail, with special reference to aqueous Cr(en) sub 3(3-). The various possible regimes of rate constant values in all cases but one lead to physically questionable absolute values. The acceptable regime is that in which the first doublet thexi state is directly chemically reactive. A challenge to the reading of earlier results on the monitoring of the rate of appearance of the primary photoproduct is discussed, and dismissed. GRA

N80-28706# Oak Ridge National Lab., Tenn. Solid State Div.

MELTING BY PULSED LASER IRRADIATION
J. Narayan and C. W. White 1979 5 p refs Presented at Symp. on the Sci. Basis for Nucl. Waste Management, Boston, 26 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791112-59) Avail: NTIS HC A02/MF A01

The phenomenon of melting produced by pulsed ruby laser gamma = 0.694 micro m) irradiation was investigated. Removal of dopant precipitates, dislocations and loops during laser irradiation provided clear evidence of melting. The depth of melting was determined as a function of laser parameters (energy density and pulse duration) from the thickness of defect free regions and lengths of reoriented dislocation segments. DOE

N80-28707# Oak Ridge National Lab., Tenn. Solid State Div.
MACROSCOPIC THEORY OF PULSED LASER ANNEALING
R. F. Wood, J. C. Wang, G. E. Giles, and J. R. Kirkpatrick Dec. 1979 19 p refs Submitted for publication
(Contract W-7405-eng-26)
(CONF-791112-54) Avail: NTIS HC A02/MF A01

Radiation from high-power Q-switched lasers was used to anneal the lattice damage caused by ion implantation, diffuse surface deposited dopant films, recrystallized doped amorphous films deposited on substrates, and remove precipitates present after conventional high temperature dopant diffusion. All of these processes were studied in terms of models based on macroscopic diffusion equations for heat and mass transport, cast in a finite difference form to allow for the temperature and spatial dependence of the thermal conductivity, absorption coefficient, reflectivity, and other quantities. Results of calculations on silicon with the models show that the near surface region of a sample can melt and stay molten for times of the order of 100 nsec during which dopant diffusion in the liquid state and nonequilibrium segregation during ultrarapid recrystallization are sufficient to explain the major features of the experimental results. DOE

N80-28708# KMS Fusion, Inc., Ann Arbor, Mich.
ENGINEERING ASPECTS OF CRYOGENIC LASER-FUSION TARGETS
D. Musinski, T. M. Henderson, R. J. Simms, T. R. Pattinson, and R. B. Jacobs (Jacobs (R. B.) Associates, Inc., Boulder, Colo.) 6 Jun. 1979 33 p refs Presented at Cryog. Eng. Conf., Madison, Wis., 21 Aug. 1979 Submitted for publication
(Contracts DE-AC08-78DP-40030; ES-77-C-02-4149; EY-76-C-02-2709; ED-78-C-08-1598)
(KMSF-U-907; CONF-790815-36) Avail: NTIS HC A03/MF A01

Most current laser-fusion targets consist of hollow spherical glass shells which have been filled with a mixture of gaseous deuterium-tritium fuel. Theoretical considerations suggest that optimum yields can be obtained from these targets if the fuel is condensed as a uniform liquid or solid layer on the inner surface of the glass shell at the time it is irradiated. In principle, this can be accomplished in a straightforward way by cooling the target below the condensation or freezing point of the fuel. In practice, cryogenic targets can appear in routine laser experiments only when the necessary cryogenic technology is reliably integrated into experimental target chambers. Significant progress was made recently in this field. The scientific basis and the various engineering features of a system which has allowed the successful irradiation of uniform solid-fuel-layer targets are discussed. DOE

N80-28709# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
LASER TRIGGERED SPARK GAP USING FIBER OPTIC TRANSMISSION
H. C. Harjes 12 Dec. 1979 79 p refs
(Contract W-7405-eng-48)
(UCRL-15202; SR-1) Avail: NTIS HC A05/MF A01

The use of an optical fiber in a laser triggering system is described. The fiber transmits a high power ruby laser pulse which triggers a high voltage spark gap. The spark gap is a gas switch on a water dielectric Blumlein generator which is pulse charged by a three stage Marx bank. Typical operating parameters for the spark gap are: 2 cm gap, 2700 Torr pressure, Ar-N2 gas mixture, and a charging voltage of 200 kV. The single strand, 1 mm, quartz, optical fiber is selected specifically for high power transmission capability. Laser pulses of 4 MW are coupled into and transmitted by the fiber with no observed damage. The overall optical system transmission efficiency is 62%. The triggering performance of the system is excellent in that switching delays of less than 10 ns and subnanosecond jitters are measured. DOE

N80-28710# Naval Weapons Center, China Lake, Calif.
CO2-LASER POLISHING OF FUSED SILICA SURFACES FOR INCREASED LASER DAMAGE RESISTANCE AT 1.06 MICRONS
P. A. Temple, David Milam (California Univ., Lawrence Livermore Labs., Livermore), and W. Howard Lowdermilk (California Univ., Lawrence Livermore Labs., Livermore) 3 Apr. 1980 9 p refs Presented at the Boulder Damage Conf., Boulder, Colo., 30 Oct. 1979
(Contract W-7405-eng-48)
(UCRL-84247; CONF-7910130-2) Avail: NTIS HC A02/MF A01

Bare fused silica surfaces were prepared by subjecting the mechanically polished surface to a rastered CW CO2 laser beam. Analysis shows that this processing causes: (1) removal of a uniform layer of fused silica; and (2) a probable refusing or healing of existing subsurface fractures. The fused silica removal rate is found to be a function of the laser intensity and scan rate. These surfaces are seen to have very low scatter and to be very smooth. In addition, they exhibited entrance surface damage thresholds at 1.06 microns and 1 nsec, which are substantially above those seen on the mechanically polished surface. When damage does occur, it tends to be at a few isolated points rather than the general uniform damage seen on the mechanically polished part. In addition to the damage results, an observational technique used for viewing these surfaces is discussed which employs dark field illumination. DOE

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-28711* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CIRCUMFERENTIAL SHAFT SEAL Patent
Lawrence P. Ludwig, inventor (to NASA) Issued 15 Jul. 1980 4 p Filed 31 Mar. 1976 Supersedes N76-20488 (14-11, p 1394)
(NASA-Case-LEW-12119-1; US-Patent-4,212,477; US-Patent-Appl-SN-672219; US-Patent-Class-277-193; US-Patent-Class-277-153; US-Patent-Class-277-224) Avail: US Patent and Trademark Office CSCL 11A

A circumferential shaft seal is described which comprises two sealing rings held to a rotating shaft by means of a surrounding elastomeric band. The rings are segmented and are of a rigid sealing material such as carbon or a polyimide and graphite fiber composite.

Official Gazette of the U.S. Patent and Trademark Office

N80-28712 Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de l'Energitique.
EXTENSION OF THE OPERATING RANGE OF A HIGH COMPRESSION RATIO CENTRIFUGAL COMPRESSOR Final Report [ELARGISSEMENT DU DOMAINE DE FONCTIONNEMENT D'UN COMPRESSEUR CENTRIFUGE A TAUX DE COMPRESSION ELEVE]
Yves Ribaud Aug. 1979 76 p refs In FRENCH
(Contract DGRST-76-7-0590)
Avail: Issuing Activity

The performance and behavior of a heavy gas compressor of simple technological design were investigated. An existing compressor with a compression ratio of 8 was converted into a compressor with an extended operating range with a compression ratio of 4. It was not possible to significantly improve the performance of the compressor. Basic calculations are given for the development of a compressor capable of fulfilling the required

objectives (wide operating range, high performance).
Author (ESA)

N80-28713*# Boeing Aerospace Co., Seattle, Wash.
CABLES AND CONNECTORS FOR LARGE SPACE SYSTEM TECHNOLOGY (LSST) Final Report
W. G. Dunbar Apr. 1980 104 p refs
(Contract NAS8-33432)
(NASA-CR-161423) Avail: NTIS HC A06/MF A01 CSCL 13E

The effect of the environment and extravehicular activity/remote assembly operations on the cables and connectors for spacecraft with metallic and/or nonmetallic structures was examined. Cable and connector philosophy was outlined for the elctrical systems and electronic compartments which contain high-voltage, high-power electrical and electronic equipment. The influence of plasma and particulates on the system is analyzed and the effect of static buildup on the spacecraft electrical system discussed. Conceptual cable and connector designs are assessed for capability to withstand high current and high voltage without danger of arcs and electromagnetic interference. The extravehicular activities required of the space station and/or supply spacecraft crew members to join and inspect the electrical system, using manual or remote assembly construction are also considered.
A.R.H.

N80-28714*# National Aeronautics and Space Administration, Washington, D. C.
EFFECTS OF SUPPLY CONDITIONS ON FILM THICKNESS IN LUBRICATED HERTZIAN CONTACTS
G. Dalmaz and M. Godet May 1980 27 p refs Transl. into ENGLISH from Mec. Materiaux Elec. (France), no. 296-297, Aug. - Sep. 1974 p 25-34 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by National Inst. for Applied Sciences, Lyon
(Contract NASw-3198)
(NASA-TM-75782) Avail: NTIS HC A03/MF A01 CSCL 13I

A generalization of the hydrodynamic expression for Hertzian contacts is described and various methods for calculating the thickness of the oil film winter steady-state, isothermal conditions are given. This is important for engineering applications such as gears and bearings because these results are closer to real operating conditions. Theories of lubrication are discussed, and the mathematics involved are presented using approximately 30 equations and 13 figures. For lubricated, linear, elliptical or point Hertzian contacts it is demonstrated how to calculate the thickness of the oil film at the center of the contact for steady-state isothermal conditions.
L.F.M.

N80-28715*# Stanford Univ., Calif. High-Energy Physics Lab.
SUPERCONDUCTING BEARINGS FOR APPLICATION IN CRYOGENIC EXPERIMENTS IN SPACE Final Report
C. W. F. Everitt and Paul W. Worden, Jr. Jun. 1980 65 p refs
(Contract NAS8-32605)
(NASA-CR-161526) Avail: NTIS HC A04/MF A01 CSCL 13I

Linear superconducting magnetic bearings suitable for use in a proposed orbital equivalence principle experiment and for general application in space were developed and tested. Current flows in opposite directions in adjacent superconducting wires arranged parallel to the axis of a cylinger. This configuration provides maximum stiffness radially while allowing the test mass to move freely along the cylinder axis. In a space application, the wires are extended to cover the entire perimeter of the cylinder: for the earth-based tests it was desirable to use only the bottom half. Control of the axial position of the test mass is by small control coils which may be positioned inside or outside the main bearing. The design is suitable for application to other geometries where maximum stiffness is desired. A working model scaled to operate in a 1-g environment was perfected approximate solutions for the bearings were developed. A superconducting transformer method of charging the magnets for the bearing, and a position detector based on a SQUID magnetometer and associated superconducting circuit were also investigated.
A.R.H.

N80-28716*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
KINEMATIC CORRECTION FOR ROLLER SKEWING
Michael Savage (Akron Univ.) and Stuart H. Loewenthal Oct. 1980 46 p refs Proposed for presentation at 16th Biom. Mech. Conf., Beverly Hills, Calif., 29 Sep. - 1 Oct. 1980; sponsored by ASME
(NASA-TM-81564; E-526) Avail: NTIS HC A03/MF A01 CSCL 13I

A theory of kinematic stabilization of rolling cylinders is developed for high-speed cylindrical roller bearings. This stabilization requires race and roller crowning to product changes in the rolling geometry as the roller shifts axially. These changes put a reverse skew in the rolling elements by changing the rolling taper. Twelve basic possible bearing modifications are identified in this paper. Four have single transverse convex curvature in the rollers while eight have rollers with compound transverse curvature composed of a central cylindrical band of constant radius surrounded by symmetric bands with both slope and transverse curvature.
Author

N80-28717*# Georgia Inst. of Tech., Atlanta. School of Mechanical Engineering.
SURFACE TEMPERATURES AND GLASSY STATE INVESTIGATIONS IN TRIBOLOGY Annual Report
Scott Bair and Ward O. Winer Jul. 1980 125 p refs
(Grant NsG-3106)
(NASA-CR-163389) Avail: NTIS HC A06/MF A01 CSCL 20K

Measurements were made of the limiting shear stress for two naphthenic oils of differing molecular weight and three blends of the lower molecular weight oil and polymers of differing molecular weight. All reached the same limiting shear stress for the same temperature and pressure; although the polymer solutions reduced the limiting shear stress by about fifteen percent. A falling body viscometer was constructed to operate to 230 C and to 0.6 GPa and another was constructed to extend the pressure range to 1.1 GPa. A concentrated contact simulator was developed which allows recording of the traction force while the slide-roll ratio is continuously varied and the rolling speed is maintained essentially constant. Measurement of lubricant minimum film thickness of elliptical EHD contacts of various aspect ratios were made by optical interferometry. The experimental data were thirty percent greater than that predicted by the Hamrock and Dowson model. Preliminary development of the application of a scanning infrared radiation system to a tribological system was completed.
L.F.M.

N80-28718*# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Materials Integrity Branch.
THE EVALUATION OF SOME THREADED INSERTS Final Report, Jan. 1975 - Mar. 1978
Alton W. Brisbane Oct. 1979 175 p refs
(AF Proj. 2418)
(AD-A085070; AFML-TR-78-107) Avail: NTIS HC A08/MF A01 CSCL 13/5

This report presents: (1) fatigue data for 7075-T73 aluminum alloy plate containing threaded inserts; (2) the results of tests for determining the tensile load required to pull threaded insert out of the parent material; (3) the torque required to lock and unlock a bolt threaded into the insert; and (4) the susceptibility of the insert to corrosion when threaded into the parent material and exposed to a corrosive media. The types of threaded inserts evaluated consisted of solid wall bushings, helical coils, and the solid wall self-tapping bushings.
GRA

N80-28719*# Northrop Corp., Des Plaines, Ill. Defense Systems Div.
METAL-CERAMIC SEALS Final Technical Report, 15 Feb. 1978 - 15 Jun. 1979
Yeldez Amer and Gunther Dohler Wright-Patterson AFB, Ohio AFAL Oct. 1979 124 p refs
(Contract F33616-78-C-1405; AF Proj. 2002)
(AD-A084860; AFAL-TR-79-1106) Avail: NTIS HC A06/MF A01 CSCL 11/2

This program describes the results obtained during a one year study program on high power microwave and millimeter wave windows. The objective of this program was to investigate

the applicability of a new ceramic metalization process to the fabrication of waveguide windows. The new metallization process, developed recently by Northrop, consists in sputtering a Ti-Mo-Cu Layer onto the ceramic and has shown to exhibit extremely high bond strength, reliability and very low thermal barriers and rf losses when compared to the classical Mo-Mn metallization. Three types of rf windows were fabricated, mainly for I/J band applications: circular windows, rectangular waveguide windows and coaxial windows. The advantages of the Ti-Mo-Cu metallization process as compared to the classical Mo-Mn process have been quantitatively defined, and excellent results have been obtained. The rf losses have been found to be excellent if cusil is used as brazing alloy, and extremely low thermal barriers have been measured. The use of Au/Cu brazing alloys results in higher reliability under thermal cycling conditions, but increases drastically the rf losses. GRA

N80-28720# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
MECHANICAL ARM CONTROL
Richard C. Waters Oct. 1979 23 p refs
(Contracts N00014-75-C-0643; N00014-77-C-0389)
(AD-A084820; AI-M-549) Avail: NTIS HC A02/MF A01 CSCL 13/3

This paper discusses three main problems associated with the control of the motion of a mechanical arm: (1) transformation between different coordinate systems associated with the arm, (2) calculation of detailed trajectories for the arm to follow, and (3) calculation of the forces which must be applied to the joints of the arm in order to make it move along a specified path. Each of the above problems is amenable to exact solution. However, the resulting equations are, in general, quite complex and difficult to compute. This paper investigates several methods for speeding up this calculation, and for getting approximate solutions to the equations. GRA

N80-28721# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
MATERIALS RESEARCH FOR ADVANCED INERTIAL INSTRUMENTATION. TASK 2: GAS BEARING MATERIAL DEVELOPMENT BY SURFACE MODIFICATION OF BERYLLIUM Technical Report, 1 Oct. 1978 - 30 Sep. 1979
D. Das, K. Kumar, E. Wettstein, and J. Wollam Oct. 1979 70 p refs
(Contract N00014-77-C-0388)
(AD-A084780; R-1330; TR-2) Avail: NTIS HC A04/MF A01 CSCL 17/7

The purpose of this program is to produce an adherent, low friction and wear resistant coating on a beryllium surface by in-situ formation of boride or borides of beryllium, with this goal being pursued via two distinct avenues of approach, i.e., diffusion, and ion implantation. This report covers a period of roughly one year since October 1978. In the portion of the work which features diffusion from a solid boron source, it is now determined that the cause of earlier failures in producing bonded boride to beryllium substrates was due to formation of an oxide layer at the interface. Other significant accomplishments in the study of reactive diffusion process during this period are: (1) thin (about 1 micrometer) and uniform films of as yet unidentified hard beryllium borides have been produced by chemical vapor deposition which are highly adherent with a strong potential for high wear resistance as indicated by its resistance to conventional polishing procedures; (2) development of a successful technique of producing well bonded Be-B diffusion couples by hot isostatic pressing; and (3) production of solid gamma boron by Arc Plasma Spraying suitable for fabrication Be-gamma B diffusion couples, which is not available otherwise. For the process of boriding by ion implantation, the feasibility of attaining very high (40 and 60 a/o) boron concentrations in the near-surface of beryllium has been demonstrated. Sample format and procedures have been devised which will provide the largest amount of information for the least investment of time in the ion implantation equipment. GRA

N80-28722# Naval Research Lab., Washington, D. C.
FAILURE ANALYSIS OF ROLLER CHAIN DRIVES
F. R. Stonesifer, H. L. Smith, and D. A. Meyn 4 Apr. 1980 27 p ref
(AD-A084989; AD-E000422; NRL-MR-4202) Avail: NTIS HC A03/MF A01 CSCL 20/11

Results from the NAVSEA sponsored task to analyze failures of a roller-chain drive are reported. Several unexpected failures had occurred after relatively short exposure to sea water. This led to an inspection of the broken parts and fracture surfaces in an effort to determine causes of failure. The static breaking strength and fatigue life of the chain were determined by laboratory tests. Both optical and scanning electron micrographs were used in the analysis. Results show tensile overloading to be the principal cause of failure. However stress corrosion cracking may have reduced the useful life of the case hardened roller-chain pins. Modifications to improve the integrity of the system are recommended. GRA

N80-28723# Sandia Labs., Albuquerque, N. Mex.
HYDROGEN ACTUATED PUMP
C. J. M. Northrup and A. A. Heckes 1980 20 p refs Presented at the Intern. Symp. on the Properties and Appl. of Metal Hydrides, Colorado Springs, Colo., 7 Apr. 1980
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-1656C; CONF-800402-10) Avail: NTIS HC A02/MF A01

Hydrogen was used as the motive fluid in a novel water pump. The principle of operation of the pump was that a metal hydride may be heated to decompose the hydride to produce a metal alloy and hydrogen at elevated pressure. The high pressure hydrogen expanded as it moved a flexible but impermeable diaphragm to produce a displacement capable of doing work. When the metal alloy powder was cooled the hydrogen was reabsorbed at the low (or expanded) pressure to return the system to its original condition. A laboratory prototype pump is shown and its thermal efficiency discussed. In practice, the laboratory prototype had a thermal efficiency of 2.4% and with simple design improvements is calculated to be capable of an efficiency of 5%. DOE

N80-28724# Encotech, Inc., Schenectady, N.Y.
WORLDWIDE SURVEY OF CURRENT EXPERIENCE BURNING RESIDUAL AND CRUDE OILS IN GAS TURBINES Final Report
B. O. Buckland, F. H. Kindl, and H. Lukas Dec. 1979 87 p refs
(EPRI-AF-1243) Avail: NTIS HC A05/MF A01

Owners of gas turbines burning residual fuel were surveyed to identify operating problems, costs, and general owners' reaction to burning residual fuel. Owners were contacted by mail and personal visits and the results are summarized. The general conclusion is that residual oil is a practical fuel for gas turbines. It is also indicated that capital and operating costs will be higher and extra attention to system design is required as compared with distillate operation. When the cost differential between distillate and residual (or crude) fuel justifies it, residual is a practical alternative. DOE

N80-28725# Shaker Research Corp., Ballston Lake, N. Y.
ROTOR-BEARING DYNAMICS TECHNOLOGY DESIGN GUIDE. PART 5: DYNAMIC ANALYSIS OF INCOMPRESSIBLE FLUID BEARINGS Interim Report, 15 Sep. 1977 - 15 Jan. 1978
Paul E. Allaire, John C. Nicholas, Edgar J. Gunter, and Coda H. T. Pan Wright-Patterson AFB, Ohio AFAPL Mar. 1980 95 p refs
(Contract F33615-76-C-2038; AF Proj. 3048)
(AD-A085106; SRC-78-TR-35-Pt-5; AFAPL-TR-78-6-Pt-5) Avail: NTIS HC A05/MF A01 CSCL 13/9

This report gives the equilibrium position, bearing coefficients, friction torque, and oil flow for plain journal, multilobe, and tilting pad journal bearings. For multilobe bearings, various combinations of preload, number of pads, and load direction are evaluated. Tilting pad bearings are analyzed for various combinations of length to diameter ratio, preload, number of pads, and load direction. GRA

N80-28726# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
DEVELOPMENT OF HIGH-TEMPERATURE TURBINE SUBSYSTEM TECHNOLOGY TO A TECHNOLOGY READINESS STATUS, PHASE 2 Quarterly Report, Apr. - Jun. 1979

1979 207 p refs
(Contract EX-76-C-01-1806)
(FE-1806-67) Avail: NTIS HC A10/MF A01

Progress in a program for developing a gas turbine for use in a combined-cycle power plant using coal-derived gas fuel combusted at temperature from 2600 F to 3000 F is reported. Information is included on component design and testing, system design and performance analyses, and updating the previous combined-cycle studies to evaluate the commercial viability of the turbine system. DOE

N80-28727# Turbodyne Corp., Wellsville, N.Y. Steam Turbine Div.

RESEARCH AND DEVELOPMENT OF IMPROVED EFFICIENCY SMALL STEAM TURBINES (IESST), PHASE 1 Technical Progress Report, 16 Apr. - 31 Dec. 1979

D. M. Choate and A. H. Tuttle Jan. 1980 39 p
(Contract DE-AC03-79ET-15428)
(DOE/ET-15428/T2) Avail: NTIS HC A03/MF A01

Product statistical bulletins of the National Electrical Manufacturers Association and Turbodyne's shipment records over a 10 year period were researched to determine quantities installed and to define general parameters of design. Engineering studies were conducted to determine the optimum turbine design to meet the defined design parameters. Two conceptual designs plus an added variation of one design were completed together with designs of gearing required to provide speeds compatible with driven equipment speeds. The calculated performance of the recommended design and currently available small steam turbines were compared and a life cycle cost analysis was conducted to determine the economic competitiveness of the new design. DOE

N80-28728# Societe Nationale Industrielle Aerospatiale, Paris (France).

HIGH PRESSURE GAS STORAGE CAPACITIES. EXAMPLE OF A SOLUTION USING FILAMENT WINDINGS [CAPACITIES POUR STOCKAGE DE GAZ A HAUTE PRESSION. EXEMPLES DE SOLUTION UTILISANT LE BOBINAGE FILAMENTAIRE]

A. Phan and J. Lamalle 1979 19 p refs In FRENCH Presented at Journees du Verre Textile et des Plastiques Renforces Conf., 1978
(SNIAS-792-430-104) Avail: NTIS HC A02/MF A01

The work described is based on the use of epoxy resin fiber glass. Economic factors affecting the choice of materials are discussed. Specific examples are treated; the physical nature of the windings are described together with the results obtained. The study demonstrates that a substantial reduction in mass, and an enhanced level of safety can be assured at a competitive cost by storing gases in this way. Author (ESA)

N80-28729# Societe Nationale Industrielle Aerospatiale, Cannes (France).

CENTRIFUGAL REGULATOR FOR CONTROLLING DEPLOYMENT RATES OF DEPLOYABLE ELEMENTS

J. C. Vermalle Paris 1979 10 p
(SNIAS-792-440-102) Avail: NTIS HC A02/MF A01

The requirements, design and performance of a centrifugal regulator aimed at limiting deployment rates of deployable elements is described. This mechanism which uses centrifugal force to produce friction of studs, was designed, manufactured, and tested to the specifications for the International Ultraviolet Explorer (IUE) solar array. Author (ESA)

N80-28730# Societe Nationale Industrielle Aerospatiale, Paris (France).

THE GLUING OF METALS [LE COLLAGE DES METAUX]

Georges Jube 1979 20 p In FRENCH Presented at Journees Jules Jarry Conf., Paris, Jun. 1979
(SNIAS-792-502-102) Avail: NTIS HC A02/MF A01

The principles and advantages of gluing metallic parts are discussed and reviewed. Practical aspects of the technique are discussed and the structures for which this technique is most useful are presented (e.g., optimized surface: honeycombed structures). The limits of the technique are examined; in certain cases, the forces to which the parts to be joined will be subjected render such methods inapplicable. The long term behavior of glued joints seems to be more influenced by the properties of the underlying metals than the behavior of the joint itself. Corrosion and aging are also discussed. The evolution of the technique and the state-of-the-art are presented. Author (ESA)

N80-28731# General Electric Co., Whetstone (England). Reactor Equipment Ltd.

INVESTIGATION OF PE16 WELDS WITH REDUCED TENSILE STRENGTH Final Report

G. Rowden Jun. 1979 15 p refs
(REL/R(79)24) Avail: NTIS HC A02/MF A01

A large body of tensile data were analyzed and a mean reduced tensile strength for the PE16/PE 16 weld test joint of 56.5 tsi with an estimated population standard deviation of 2.25 tsi was established. Tensile fractures were examined and it is shown that they contained mixed trans and intergranular fracture, increased amounts of intergranular fracture tending to produce the lower strength levels. Weld metal defects found on some of the early fractures have not had a significant effect on joint properties. Some minor changes to the welding technique were made, but in general, the investigation has confirmed the adequacy of the established welding and inspection techniques. It is concluded that there is no reason to question the serviceability of installed tie bars. Author (ESA)

N80-28732# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

COMBINED EFFECTS OF PERIODIC AND STOCHASTIC LOADS ON THE FATIGUE OF WIND TURBINE PARTS, PART 6

Andre Raab (Sikob AB) 29 Oct. 1979 60 p refs 6 Vol.
(Contract SWEDBESD-5061-012)
(FFA-AU-1499-Pt-6) Avail: NTIS HC A04/MF A01

Selected topics on simulation of turbulence and fatigue evaluation of wind turbines are presented. The importance of correct application of random loads and the mathematical description of nonstationary processes (general theory) are discussed. The two point cross spectra of turbulence, with regard to shear flow in the boundary layer of the Earth and to the inclination of wind gusts, is determined. The two point correlation functions of turbulence when these points are situated on rotating blades is evaluated. The discrete form of the correlation functions giving the correlation matrix and the properties of this matrix in the case of band limited processes are given. Band limited, Gaussian, multivariate random processes, having a prescribed correlation matrix, are simulated with the aid of Choleski's algorithm. The application of the described theory to the evaluation of fatigue in the case of wind turbines is shown. Author (ESA)

N80-28733# Saab-Scania, Goteberg (Sweden).

A TEST OF THE TORQUE LOSS OF A PLATFORM AXIS AT OSCILLATING MOVEMENTS

Ragnar Persson 16 Aug. 1979 17 p refs
(SAAB-RRK-79-58) Avail: NTIS HC A02/MF A01

The oscillating movements of the elevation axis of a pointing platform were measured with respect to temperature gradients, amount of axial displacement during temperature cycling, average torque loss and torque loss ripple for movements 45, 15, 25, and 15 deg. The bearing support and preload were based upon the use of an O-ring as the main load carrying element. Thus, there will be no sliding of inner or outer rings of the bearings and consequently no need for lubrication for that purpose, only the bearings themselves were lubricated. The O-ring side of the bearing system showed a very low temperature gradient between inner and outer bearing rings, in the intervals of the temperature cycling when temperature was steadily rising or falling. A temperature gradient less than 5 deg was found over the bearing with the O-ring, compared to 10 deg over the conventionally supported bearing. An average torque loss of 0.1 Nm, an average torque loss ripple of less than 0.05 Nm and a peak torque loss ripple of less than 0.15 Nm were measured. Author (ESA)

N80-28734# Massachusetts Inst. of Tech., Cambridge. Energy Lab.

HYDROCARBON FORMATION AND OXIDATION IN SPARK-IGNITION ENGINES. VOLUME 1: SUMMARY Final Report, Sep. 1976 - Aug. 1979

John B. Heywood, James C. Keck, and Joe M. Rife Jan. 1980 44 p Sponsored in part by General Motors Research Labs., Warren, Mich.
(PB80-166085; MIT-EL-80-003) Avail: NTIS HC A03/MF A01 CSCL 21B

The key results and conceptual findings are summarized from a three year research program on hydrocarbon formation and oxidation mechanisms in spark ignition engines. Major emphasis is given to the following: laminar flame quenching experimental and analytical studies; quench layer studies in a spark ignition engine using a rapid acting gas sampling valve; flow visualization studies in a transparent engine to determine quench layer and quench crevice gas motion; studies of heat transfer, mixing and hydrocarbon oxidation in the exhaust port. GRA

N80-28735# Transportation Systems Center, Cambridge, Mass.
PERFORMANCE CHARACTERISTICS OF 1977 GENERAL MOTORS 350 CID ENGINE Final Report
Joseph Boziuk Feb. 1980 48 p
(PB80-170012; DOT-TSC-NHTSA-80-11; DOT-HS-805222) Avail: NTIS HC A03/MF A01 CSCL 21G

Experimental data were obtained in dynamometer tests of a 1977 GM 350 CID engine to determine fuel consumption and emissions (hydrocarbons, carbon monoxide, and oxides of nitrogen) at steady state engine operating modes. The objective of the test was to obtain engine performance data for estimating fuel consumption and emissions for varied engine service and duty and to provide basic engine characteristic data required for the TSC Vehicle Simulator (VEHSIM). GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-28736# Clemson Univ., S.C. Dept. of Mathematical Sciences.
DISTRIBUTION-FREE TOLERANCE BOUNDS FOR THE LIFETIME OF AN M-OUT-OF-K SYSTEM OF COMPONENTS
K. M. Lal Saxena Sep. 1979 19 p refs
(Contract N00014-75-C-0451; ONR Proj. 047-202)
(AD-A084899; N109; TR-323) Avail: NTIS HC A02/MF A01 CSCL 14/4

Distribution-free tolerance bounds are obtained for the life time of an m-out-of-k system of unlike components. It is assumed that the life time distributions of the k components belong to a stochastically order family of distributions. Two criteria are used to determine the tolerance bounds. These criteria are extensions of the criteria used in a single population literature. GRA

N80-28737# Battelle Columbus Labs., Ohio. Tactical Technology Center.
A QUALITY CONTROL DATA MANAGEMENT SYSTEM Final Report, Jun. 1977 - Feb. 1978
M. B. Neher and R. E. Heffelfinger 28 Feb. 1978 113 p
(Contract DAAK40-73-C-0142)
(AD-A084896; BATT-CDIR-1-2; DRXTH-TD-CR-80069) Avail: NTIS HC A06/MF A01 CSCL 09/2

A laboratory quality control system has been programmed for the Hewlett-Packard 3384 Computer used in Installation Restoration analytical chemistry laboratories. GRA

N80-28738# Central Electricity Generating Board, Harrogate (England). Scientific Services Dept.
THE IN-SITU ULTRASONIC EXAMINATION OF LARGE GENERATOR ROTORS
A. J. M. Lichnowski Jul. 1979 12 p
(TDB-330) Avail: NTIS HC A02/MF A01

A technique is described for carrying out an ultrasonic examination of the body of a large generator rotor. The test is conducted from the outer surface of the rotor using an inspection device which manipulates within the internal annular space of the machine between the rotor and the stator. The inspection procedures and the three components of the inspection device (the articulation unit, the sensing unit, and the jacking mechanism) are described. Author (ESA)

N80-28739# National Technical Information Service, Springfield, Va.
RELIABILITY: MATHEMATICAL TECHNIQUES. CITATIONS FROM THE NTIS DATA BASE Progress Report, Jun. 1977 - Apr. 1980
George W. Reimherr Apr. 1980 106 p Supersedes NTIS/PS-79/0451; NTIS/PS-78/0439
(PB80-809486; NTIS/PS-79/0451; NTIS/PS-78/0439) Avail: NTIS HC $30.00/MF $30.00 CSCL 14D

The cited reports discuss reliability prediction using mathematical techniques. Topics covered include statistical analysis, fault tree analysis, life testing, failure analysis, and mathematical models as applied to reliability prediction. This updated bibliography contains 99 abstracts, 20 of which are new entries to the previous edition. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-28740# Materials Research Labs., Melbourne (Australia).
A HIGH-SENSITIVITY POTENTIAL-DROP TECHNIQUE FOR FATIGUE CRACK GROWTH MEASUREMENTS
Graham Clark Aug. 1979 37 p refs
(MRL-R-755; AR-001-837) Avail: NTIS HC A03/MF A01

The design features of a highly sensitive and accurate system for monitoring the growth of fatigue cracks in laboratory specimens of various geometries are described. The system is based on the potential-drop method which utilizes the electrical resistance changes associated with fatigue crack growth through the specimen cross-section to detect crack length increments of a few micrometers. The technique is suitable for automation, and tests may be completed with a minimum amount of operator interference. A computer-based data-processing method is described, and the performance of the system in measuring both absolute crack length and crack growth rate is evaluated. A.R.H.

N80-28741# National Mechanical Engineering Research Inst., Pretoria (South Africa). Special Projects Div.
PROTOTYPE OF WIRE BREAK DETECTOR
L. Stawiszynski Aug. 1979 41 p
(CSIR-ME-1626; ISBN-0-7988-1464-0) Avail: NTIS HC A03/MF A01

Fracture of a single wire in wire rope fatigue testing cannot be detected by visual observation and usually is discovered only by terminating the test and unravelling the test specimen to allow a count of the broken wires. The Wire Break Detector (WBD) was designed and developed to allow detection and counting of wire fractures without interrupting the fatigue testing. When a fracture occurs in a single wire of a rope test specimen, a shock is generated and the impact is transmitted to the end fittings. By having accelerometers placed at both the upper and lower end fittings, these shocks can be measured and recorded allowing a determination of the fracture location. Details of the WBD design with auxiliary counters and displays are presented. L.F.M.

N80-28742*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CONTROL-STRUCTURE INTERACTION IN A FREE BEAM
S. K. Shrivastava and R. C. Ried May 1980 17 p refs
(NASA-TM-81029; JSC-16699) Avail: NTIS HC A02/MF A01 CSCL 20K

A simple energy approach to study the problem of control structure interactions in large space structures is presented. For the illustrative case of a free-free beam, the vibrational energy imparted during operation of constant, step, and pulsed thrusters is found in a nondimensional closed form. Then based

on a parametric study, suggestions are made on the choice of parameters to minimize the control structure interactions. The study of this simple system provides physical insight and understanding for more complex systems. Author

N80-28743*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
BOLT-BEARING FATIGUE OF A GRAPHITE/EPOXY LAMINATE
Jonn H. Crews, Jr. Jul. 1980 27 p refs Presented at ASTM Specialist Symp. on Joining of Composite Mater., Minneapolis, 15-16 Apr. 1980
(NASA-TM-81851) Avail: NTIS HC A03/MF A01 CSCL 20K

Graphite/epoxy laminates were tested under bolt-bearing loads for a range of bolt clampup torques and for several test conditions involving water. High clampup torque improved both the static strength and fatigue limit by about 100 percent compared to a simple pin-bearing case, which had no through-the-thickness constraint. The static strength improvement was explained in terms of failure modes. Bolt clampup also influenced the hole elongation that developed before failure. For both the static and fatigue tests, the hole elongations were much larger for the low-torque clampup. Tests in water degraded static bearing strength only slightly, but reduced the fatigue limit about 40 percent below that for tests conducted in air. Author

N80-28744# Brown Univ., Providence, R. I.
PLASTIC DEFORMATION AND FRACTURE OF STEEL UNDER DYNAMIC LOADING Final Report, 15 Dec. 1976 - 31 Jan. 1980
R. J. Clifton and J. Duffy May 1980 11 p refs
(Grant DAAG29-77-G-008)
(AD-A084949; ARO-14363.3-E) Avail: NTIS HC A02/MF A01 CSCL 11/6

The authors summarize their research effort during the grant period. Included is a comprehensive study relating dynamic plasticity and fracture initiation through experiments on 1020 hot rolled steel and 1018 cold rolled steel. A comparison of values of K sub Ic obtained using the method developed by Brown University and the instrumented precracked Charpy test is given as well as a finite element of the specimen configuration used in the dynamic plasticity experiments utilizing a torsional Kolsky bar. An experimental investigation into the formation of shear bands in low carbon steel including the measurement of the temperature rise during the formation of the shear band as well as the derivation of a criterion for predicting shear band formation is reported. Further, the details of the development of a plate impact experiment designed to attain strain rates of ten to the 5th power per s up to strains of 10% and pressures of more than 10k bar are also reported. GRA

N80-28745# Battelle Columbus Labs., Ohio.
DYNAMIC FRACTURE TOUGHNESS PARAMETERS FOR HY-80 AND HY-130 STEELS AND THEIR WELDMENTS Interim Report
G. T. Hahn (Vanderbilt Univ.) and M. F. Kanninen Aug. 1979 42 p refs
(Contract N00014-77-C-0576)
(AD-A085194) Avail: NTIS HC A03/MF A01 CSCL 11/6

Lower bound dynamic fracture toughness parameters for HY-80 and HY-130 steel and their weld metals are identified. Specific values of the parameters K sub Id and K sub Im obtained from direct measurements are reported together with estimates inferred from the large body of Charpy energy, nil ductility transition temperature and dynamic tear energy measurements. The emphasis is on reasonable lower bound values at 30 F, the lowest anticipated service temperature, for use in elastodynamic analyses of crack growth initiation, propagation, and arrest in ship structures. For these conditions, it has been found that the ratio K sub Id/RHO sub Y is approximately sq root of 1 in. Consequently, HY-80 plate appears to be substantially more resistant to fracture under dynamic loading than are the other three grades examined. GRA

N80-28746# Naval Postgraduate School, Monterey, Calif.
THE INFLUENCE OF THERMOMECHANICAL PROCESSING AND HEAT TREATMENT ON THE FATIGUE RESISTANCE AND FRACTOGRAPHIC CHARACTERISTICS OF A HIGH-CARBON BEARING STEEL M.S. Thesis
Ik Sik Chung Dec. 1979 121 p refs
(AD-A085060; NPS-69-79-012) Avail: NTIS HC A06/MF A01 CSCL 11/6

This study examined the effects of thermomechanical processing and subsequent conventional heat treatment on microstructure and fatigue in AISI 52100 steel. The thermo-mechanical processing techniques are essentially those described by Sherby and his co-workers at Stanford University. Previous research by that group and at the Naval Postgraduate School has demonstrated that a wide range of ferrite matrix grain sizes and carbide particle distributions can be obtained in this steel. Studies parallel with this are examining the subsequent heat treatment response of these structures and also the fracture toughness attainable. In this study on fatigue, it was found that both the fatigue life at a given cyclic stress and the endurance limit were improved by processing to produce an ultra-fine grained ferrite-carbide microstructure prior to heat treatment. Improvement in fatigue resistance was especially pronounced when the material was heat treated to fine Bainitic, rather than Martensitic microstructures. These improvements are postulated to result from changes in crack propagation mode and improved resistance to fatigue crack propagation. GRA

N80-28747# SRI International Corp., Menlo Park, Calif.
SRI PUFF 8 COMPUTER PROGRAM FOR ONE-DIMENSIONAL STRESS WAVE PROPAGATION, VOLUME 2 Final Report, Sep. 1977 - Aug. 1978
L. Seaman and D. R. Curran Mar. 1980 340 p refs
(Contract DAAK11-77-C-0083)
(AD-A084995; AD-E430434; ARBRL-CR-00420) Avail: NTIS HC A15/MF A01 CSCL 20/11

SRI PUFF is a Lagrangian finite difference computer program for calculating one-dimensional stress wave propagation through solid, liquid, gaseous, and porous materials. The calculational procedure is the standard leapfrog method of von Neumann and Richtmyer using artificial viscosity to smooth shock fronts. Planar, cylindrical, and spherical flow are treated. The constitutive relations include the standard Mie-Gruneisen equation of state and elastic, plastic (Mises or Coulomb) work-hardening deviator stress relations with thermal softening. Other pressure relations provided are a polytropic gas for explosives, GRAY and Philco-Ford three-phase equations of state, and a tabular pressure-volume relations. Special deviator stress models include the standard viscoelastic model, a Bauschinger model, dislocation models, and a nonlinear work-hardening model. Ductile and brittle fracture and shear banding are provided by nucleation and growth models. Porous materials may be represented by the Seaman-Linde model, Holt model, Herrmann P-alpha model, a cap plasticity model, and variable modulus model, or by a linear viscous void compacting model. The code is constructed for easy insertion of additional material models. The number of extra variables required for each cell for a material model can be specified in the input deck. This manual includes many sample problems, a derivation of the flow equations, discussion of material models, and an outline of other aspects of wave propagation calculation. GRA

N80-28748# Martin Marietta Labs., Baltimore, Md.
THE DELAYED FRACTURE OF ALUMINUM ALLOYS
Joseph R. Pickens, Dave Venables, and John A. S. Green May 1980 45 p refs
(Contract N00014-74-C-0277)
(AD-A085137; MML-TR-80-19C) Avail: NTIS HC A03/MF A01 CSCL 11/6

The stress corrosion cracking (SCC) of high purity Al-Zn-Mg alloys has been studied in terms of the effects on SCC susceptibility of: bulk chemistry, bulk microstructure, oxide film chemistry, and oxide film morphology. For alloys having equivalent solute content (wt. % Zn - wt. % Mg), higher bulk concentrations of magnesium lead to slightly increased susceptibility in acetic-acid-brine solution. Interrupted quenching failed to produce a microstructure exhibiting reduced SCC susceptibility. Preliminary results indicate that an oxide stripping procedure, that removes the magnesium-rich oxide film formed during heat treating, and replaces it with an amorphous alumina film, decreases SCC susceptibility. Porosity in the original castings caused data to be

scattered, so new porosity-free materials have been acquired and the oxide film studies will be repeated. GRA

N80-28749# Maryland Univ., College Park.
SURFACE EFFECTS ON PLASTIC DEFORMATION Annual Report, 1 May 1979 - 30 Apr. 1980
R. J. Arsenault and I. R. Kramer 14 May 1980 19 p
(Contract N00014-79-C-0392)
(AD-A085140; ONR-TR-80-1) Avail: NTIS HC A02/MF A01 CSCL 20/11

The present computer simulation study of the dislocation distribution near the surface is based upon a modified one-dimensional dislocation model which considers the line tension of a dislocation loop, and the image forces. If the dislocations are generated from a surface source and move by thermal activation over randomly distributed short range barriers, an inverse pile-up is created. A dislocation density gradient exists up to a depth of approximately 60 micrometers, for a total of twenty dislocations generated. During unloading, the last few dislocations generated leave the crystal rapidly, and within three hours to two weeks the dislocation density gradient essentially disappears (depending upon the parameters used). This is in agreement with the experimental results. GRA

N80-28750# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
STABILITY OF A THICK ELASTIC PLATE UNDER THRUST
K. W. Sawyers and R. S. Rivlin Mar. 1980 52 p refs Sponsored in part by NSF
(Contract N00014-76-C-0235)
(AD-A085113; CAM-100-34) Avail: NTIS HC A04/MF A01 CSCL 20/11

When a rectangular plate of incompressible neo-Hookean elastic material is subjected to a thrust, bifurcations of the flexural or barreling types become possible at certain critical values of the compression ratio. The states of pure homogeneous deformation corresponding to these critical compression ratios are states of neutral equilibrium. Their stability is investigated on the basis of an energy criterion, without restriction on the thickness of the plate. The critical state corresponding to the lowest order flexural mode is found to be stable (unstable) if the aspect ratio (thickness/length) is less (greater) than about 0.2. Agreement with the classical Euler theory is established in the limiting case of small aspect ratio. GRA

N80-28751# Battelle Columbus Labs., Ohio.
DYNAMIC CRACK PROPAGATION IN PRECRACKED CYLINDRICAL VESSELS SUBJECTED TO SHOCK LOADING Interim Report
C. H. Popelar, P. C. Gehlen, and M. F. Kanninen Aug. 1979 9 p refs Prepared in cooperation with Ohio State Univ., Columbus
(Contract N00014-77-C-0576)
(AD-A085196) Avail: NTIS HC A02/MF A01 CSCL 20/11

Previous work has shown that a speed-independent dynamic fracture toughness property can be used in an elastodynamic analysis to describe crack initiation and unstable propagation under impact loading. In this paper, a further step is taken by extending the analysis from simple laboratory test specimens to treat more realistic crack-structure geometries. A circular cylinder with an initial part-through wall crack subjected to an impulsive loading on its inner surface is considered. The crack is in a radial-axial plane and has its length in the axial direction long enough that a state of plane strain exists at the center of the crack. Crack growth initiation and propagation through the wall is then calculated. It is found that, once initiated, crack propagation will continue until the crack penetrates the wall. Crack arrest within the wall does not appear to be possible under the conditions considered in this paper. GRA

N80-28752# Naval Postgraduate School, Monterey, Calif.
SURFACE DISPLACEMENT MEASUREMENTS, STRAIN AND VIBRATIONAL ANALYSIS USING SPECKLE METROLOGY TECHNIQUES M.S. Thesis
Alan Bernard Lerchbacker Mar. 1980 154 p refs
(AD-A085145) Avail: NTIS HC A08/MF A01 CSCL 17/8

Double-exposure specklegrams were made of aluminum 2024-T4 rectangular plates. The double-exposure speckle technique was applied to the aluminum plate to measure in-plane translation and rotation and out-of-plane tilt. Strain and vibrational analyses were also conducted. The vibrational results were compared with results previously obtained using double-exposure time average holography to ascertain their applicability to Naval Engineering. Background in Fourier transforms, wave theory, Fraunhofer diffraction theory, and other areas of physical optics were investigated to enhance the development of speckle metrology techniques. Results of the experiments indicate that speckle metrology, used in conjunction with holography, has significant potential for Naval Engineering applications. Further research is required to develop these techniques. These procedures currently are being utilized extensively in the aerospace industry and automotive research and development areas. GRA

N80-28753# Battelle Columbus Labs., Ohio. Applied Solid Mechanics Section.
WHITHER DYNAMIC FRACTURE MECHANICS Interim Report
M. F. Kanninen May 1980 26 p refs Presented at the 2nd Intern. Conf. on Numerical Methods in Fracture Mech., Swansea, Wales, 6-11 Jul. 1980
(Contract N00014-77-C-0576)
(AD-A085195) Avail: NTIS HC A03/MF A01 CSCL 20/11

The experimental basis for the necessity of a dynamic characterization of crack run/arrest events is reviewed. Current anomalies in the use of linear elastodynamic treatments, apparent geometry and load rate dependence of the dynamic fracture toughness property, are discussed. A review of concurrent work in plastic fracture mechanics is given as a possible basis for circumventing these anomalies. GRA

N80-28754# Pisa Univ. (Italy). Inst. of Aeronautics.
THE FATIGUE CRACK GROWTH UNDER VARIABLE AMPLITUDE LOADING IN BUILT-UP STRUCTURES Annual Technical Report, Sep. 1978 - Oct. 1979
A. Salvetti, G. Cavallini, and L. Lazzeri Nov. 1979 87 p refs
(Grant DA-ERO-78-G-107; DA Proj. 1T1-61102-BH-57)
(AD-A084936; ATP-1) Avail: NTIS HC A05/MF A01 CSCL 21/11

The object of this investigation is the development of a reliable procedure for evaluating the growth of a crack in a built-up structure under realistic loading conditions. To this end, tests have been conducted on stiffened and unstiffened panels to monitor the growth of a crack both under constant and variable amplitude loads. The test data has been evaluated on the basis of a deep theoretical analysis which has allowed us to reach significant results on the following main topics: influence of the fastener flexibility and stringer-sheet friction forces on fatigue crack propagation in stiffened panels, reliability of existing methods for predicting the growth of a crack under loading conditions in plain sheets. GRA

N80-28755# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
CRACK-TIP FIELDS FOR FAST FRACTURE OF AN ELASTIC-PLASTIC MATERIAL Interim Report
J. D. Achenbach, M. F. Kanninen, and C. H. Popelar (Ohio State Univ., Columbus) Dec. 1979 32 p refs Prepared in cooperation with Battelle Columbus Labs, Ohio
(Contracts N00014-76-C-0063; N00014-77-C-0576)
(AD-A085261) Avail: NTIS HC A03/MF A01 CSCL 20/11

An asymptotic analysis of the near-tip fields is given for transient crack propagation in an elastic-plastic material. The material is characterized by J2 flow theory together with a bilinear effective stress-strain curve. Both plane stress and plane strain conditions have been considered. Explicit results are given for the order of the crack-tip singularity, the angular position at which unloading occurs, and the angular variation of the near-tip stresses, all as functions of the crack-tip speed and the ratio of the slopes of the two portions of the bilinear stress-strain relation. GRA

N80-28756# Sandia Labs., Albuquerque, N. Mex. Advanced Energy Projects Div.
COMPARISON WITH STRAIN GAGE DATA OF CENTRIFUGAL STRESSES PREDICTED BY FINITE ELEMENT

ANALYSIS ON THE DOE/SANDIA 17 m DARRIEUS TURBINE

Robert A. Watson Feb. 1980 20 p refs
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-1990) Avail: NTIS HC A02/MF A01

By the use of strain gages, the blade structural response to purely centrifugal loading was measured on the DOE/Sandia 17 m Darrieus rotor. The measurements obtained are compared with MARC-H nonlinear finite element stress predictions. It was necessary to include gravitational effects in the finite element model to explain certain asymmetries in the data. The model with gravitational effects shows good agreement with the data. Examination of results suggests that refinement of the model to include more structural detail in the region where the blade joins the tower would probably enhance the accuracy of the model. DOE

N80-28757# Argonne National Lab., Ill.

CHARACTERIZATION OF IMPACT FRACTURE OF BRITTLE SOLID-WASTE FORMS

W. J. Mecham, L. J. Jardine, R. H. Pelto, and M. J. Steindler 1979 13 p refs Presented at Symp. on the Sci. Basis for Nucl. Waste Management, Boston, 27-30 Nov. 1979
(Contract W-31-109-eng-38)
(CONF-791112-50) Avail: NTIS HC A02/MF A01

A methodology for analyzing particle size distributions obtained in impact testing of brittle waste form materials. The methodology includes: (1) a linear two parameter ognormal correlation of the weight fraction less than any given size; (2) a mathematical function of the two lognormal parameters to determine the total surface area in terms of a dimensionless shape factor; and (3) a surface energy constant to predict the anticipated increase of surface area from the known energy absorbed in the impact of the brittle material. Preliminary measurements are given for impacted simulated glass specimens. The analysis is used as an example of the methodology. These results are also compared with reanalyzed impact test data reported previously. DOE

N80-28758# Sandia Labs., Albuquerque, N. Mex.

CURRENT PROBLEMS IN THE FINITE DIFFERENCE SOLUTION OF STRESS WAVES

W. Herrmann Feb. 1980 36 p refs Presented at Workshop on Nonlinear Waves in Solids, Chicago Circle, Ill., 21-23 Mar. 1977; sponsored by ARO and NSF
(Contracts EY-76-C-04-0789; AT(29-1)-789)
(SAND-80-0190) Avail: NTIS HC A03/MF A01

The current state-of-the-art in finite difference calculations of nonlinear stress wave propagation in solids is outlined with special emphasis on the solution of large scale engineering problems. Considerations of computer resource economics show that one dimensional calculations of even exceedingly complex problems can be performed at small cost on small computers. Very complex two dimensional calculations can be performed, but may require the largest computers and entail significant costs. Three dimensional calculations which resolve details of stress waves are orders of magnitude beyond the capabilities of present and near term computers, although three dimensional solutions can be useful for quasi-steady problems or problems where detailed resolution is not necessary. Computational costs can be reduced by further development of finite difference methods, although order of magnitude improvement required for a real enhancement of capability is expected to require the development of methods quite different from those in use at this time. DOE

N80-28759# Bettis Atomic Power Lab., West Mifflin, Pa.

ACCEPT: A THREE-DIMENSIONAL FINITE ELEMENT PROGRAM FOR LARGE DEFORMATION ELASTIC-PLASTIC-CREEP ANALYSIS OF PRESSURIZED TUBE (LWBR/AWBA DEVELOPMENT PROGRAM)

D. N. Hutula and B. E. Wiancko Mar. 1980 135 p refs
(Contract DE-AC11-76PN-00014)
(WAPD-TM-1383) Avail: NTIS HC A07/MF A01

ACCEPT, a three dimensional finite element computer program for analysis of large deformation elastic-plastic-creep response of Zircaloy tubes subjected to temperature, surface pressures, and axial force is described. A twenty mode, tri-quadratic, isoparametric element is used along with a Zircaloy materials model. A linear time-incremental procedure with residual force correction is used to solve for the time-dependent response. The program features an algorithm which automatically chooses the time step sizes to control the accuracy and numerical stability of the solution. A contact-separation capability allows modeling of interaction of reactor fuel rod cladding with fuel pellets or external supports. DOE

N80-28760# Battelle Pacific Northwest Labs., Richland, Wash.

PROGRESS TOWARD ACOUSTIC EMISSION CHARACTERIZATION FOR CONTINUOUS MONITORING REACTOR PRESSURE VESSELS

P. H. Hutton, E. B. Schnenk, and R. J. Kurtz 1979 7 p refs Presented at the Intern. Symp. on Methods of Nondestructive Testing of Mater. and Their Appl. in Nucl. Eng., Saarbrucken, West Germany, 17 Sep. 1979
(Contract EY-76-C-06-1830)
(PNL-SA-7746; CONF-7909132-1) Avail: NTIS HC A02/MF A01

The feasibility of detecting and analyzing flaw growth in an operating reactor vessel using acoustic emission (AE) data is evaluated. A preliminary AE flaw growth relationship was developed encompassing six variables. This model relates AE count and energy to fatigue crack driving force delta K. Pattern recognition was examined as a means of distinguishing crack growth AE from other acoustic signals with encouraging results. The program is moving into hardware implementation of relationships for testing and refinement by monitoring tests in heavy section specimens and subscale structures. The hardware system will become a reactor monitor prototype. DOE

N80-28761# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Subdiv. Systemes.

MECHANICAL CHARACTERIZATION (HOOKE MATRIX AND STRENGTH) OF THREE-DIMENSIONAL SILICAPHENOLIC CYLINDERS [CARACTERISATION MECANIQUE (MATRICE DE HOOKE ET RESISTANCE A RUPTURE) DE CYLINDRES EN TROIS DIMENSIONS SILICE-RESINE PHENOLIQUE]

J. P. Dumont Paris 1979 18 p refs In FRENCH; ENGLISH summary Presented at DGRST Colloq. sur les Mater. Composites, Saclay, France, 18-22 Jun. 1979 Sponsored by CEA
(SNIAS-792-422-118) Avail: NTIS HC A02/MF A01

A method for the mechanical evaluation (Hooke matrix and strength) of 30 silicaphenolic cylinders is presented. A statistical model is fitted to a set of tests on specimens cut from cylinders with different weave parameters. Given the three fiber volume fractions, the model predicts the mean and minimum mechanical properties of 3DQP material. Author (ESA)

N80-28762# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

TRBASIS: A PROGRAM MODULE FOR TRANSIENT MODAL ANALYSIS OF LINEAR STRUCTURES, PART 1

Peter Stahlin Oct. 1979 56 p refs 6 Vol.
(Contract FMV-FFL-82223-78-003-21-001)
(FFA-HU-2125-Pt-1) Avail: NTIS HC A04/MF A01

An integrated program module of the BASIS 3 structural analysis code which performs transient analyses of linear structures is described. A summary of the theoretical relations on which the code is based is given. The operation of the program module is explained and illustrated by examples. The program is written for CDC computers. As far as the use of the program is concerned it is assumed that the reader is already familiar with the data card input to the BASIS 3 code and that he has some working knowledge of the CDC SCOPE or NOS operating systems. Author (ESA)

N80-28763# Earthquake Engineering Research Inst., Berkeley, Calif.

THE 3D TRUSS BAR ELEMENT (TYPE 1) FOR THE ANSR-2 PROGRAM

Digambar Mondkar, P. and Graham H. Powell Nov. 1979 18 p refs
(Grant NSF ENV-76-04262)
(PB80-169709; UCB/EERC-79/29; NSF/RA-790361) Avail: NTIS HC A02/MF A01 CSCL 13M

A three dimensional, inelastic, large displacement truss element developed for the ANSR-2 program is described. The element characteristics and a computer program user's guide are included. GRA

N80-28764# California Univ., Richmond. Earthquake Engineering Research Center.
BEAM-COLUMN ELEMENT 3D (TYPE 2-PARALLEL ELEMENT THEORY) FOR THE ANSR-2 PROGRAM
Ali Riahi, Graham H. Powell, and Digamber P. Mondkar Dec. 1979 35 p refs
(Grant NSF ENV-76-04262)
(PB80-167216; UCB/EERC-79/31; NSF/RA-790363) Avail: NTIS HC A03/MF A01' CSCL 13M

A three dimensional inelastic beam column element is described. A description of the element characteristics, theoretical formulation and a computer program user's guide is also given. GRA

N80-28765# Earthquake Engineering Research Inst., Berkeley, Calif.
BEAM-COLUMN ELEMENT 2D (TYPE 5-PARALLEL ELEMENT THEORY) FOR THE ANSR-II PROGRAM
Dennis G. Row, Graham H. Powell, and Digamber P. Mondkar Dec. 1979 33 p ref
(Grant NSF ENV-76-04262)
(PB80-167224; UCB/EERC-79/30; NSF/RA-79-362) Avail: NTIS HC A03/MF A01 CSCL 13M

A two-dimensional inelastic beam-column element developed for the ANSR-2 program is described. A description of the element characteristics and the computer program user's guide are included. GRA

42 GEOSCIENCES (GENERAL)

N80-28766*# State Univ. of New York at Albany.
GLOBAL TECTONIC STUDIES: HOTSPOTS AND ANOMALOUS TOPOGRAPHY
Kevin Burke, W. S. F. Kidd, S. DeLong, Richard L. Thiessen, Rosemary Carosella, and T. R. McGetchin 1979 83 p refs
(Grant NsG-5274)
(NASA-CR-163391) Avail: NTIS HC A05/MF A01 CSCL 08G

Volcanic activity on Earth and its secular variations are compared with that on other terrestrial planets. Activity at divergent, transform, and convergent plate margins is described with particular emphasis on hot spots and flood basalts. The timing and causing of uplifting above 500 meters, which in not associated with either plate boundaries or the normal nonplate margin edges of continents is considered with particular focus on the Guyana Highlands in southern Venezuela and western British Guiana, and the Brazilian Highlands in the central, eastern, and southern parts of the country. The mode and mechanism of plateau uplifting and the re-elevation of old mountain belts and subsidence of intra-continental basins are also discussed. A.R.H.

N80-28767# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
GEOELECTRICAL AND GEOMAGNETICAL MEASUREMENTS AT LAACHER SEE (EIFEL) [GEOELEKTRISCHE UNE GEOMAGNETISCHE MESSUNGEN AM LAACHER SEE (EIFEL)]
N. Kloecker and G. Musmann 1979 27 p refs In GERMAN
Sponsored by Bundesmin. fuer Forsch. u. Technol. and Comm. of European Communities
(GAMMA-35) Avail: NTIS HC A03/MF A01

Magnetic field and geoelectrical resistivity measurements taken at the Laacher See, in an ancient volcanic region of Germany are presented. Author (ESA)

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see 35 Instrumentation and Photography.

N80-28768*# Tennessee Univ. Space Inst., Tullahoma. Remote Sensing Div.
DIGITAL LANDSAT DATA ANALYSIS OF TENNESSEE Final Report, 1 Dec. 1978 - 31 Jan. 1980
F. Shahrokhi, Principal Investigator and Asif Kahn 28 Mar. 1980 56 p ERTS
(Contract NAS8-33218)
(E80-10130; NASA-CR-161424) Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-28769*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT SPECIFICATION FOR CCIT&A PROCESSOR PROGRAM
W. P. White, Principal Investigator Aug. 1978 68 p ERTS
(Contract NAS9-15200)
(E80-10168; NASA-CR-160597; LEC-12303; JSC-14368)
Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-28770*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR LACIE FORMATTED DOT CARDS IN EOD-LARSYS
P. J. Aucoin, Jr. and Jeannie Gor, Principal Investigators Apr. 1978 26 p ERTS
(Contract NAS9-15200)
(E80-10169; NASA-CR-160650; LEC-12154; JSC-13972)
Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-28771*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE YIELD ESTIMATION SUBSYSTEM (YES) OPERATIONAL ROBERTSON PHENOLOGICAL MODEL
K. Williams, Principal Investigator Jun. 1977 118 p ERTS
(E80-10170; NASA-CR-160680; LEC-10743; JSC-12941)
Avail: NTIS HC A06/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-28772*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
AS-BUILT DESIGN SPECIFICATION FOR THE I-100 TAPE READ CONSOLIDATION PROGRAM (FULOI)
T. R. Kell, Principal Investigator Jul. 1977 74 p ERTS
(Contract NAS9-15200)
(E80-10171; NASA-CR-160596; LEC-9925-Rev-A; JSC-11848-Rev-A) Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-28773*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR THE BRAZIL AND CHINA MONTHLY DATA BASES
K. Williams, Principal Investigator May 1977 20 p ERTS
(Contract NAS9-15200)
(E80-10172; NASA-CR-160677; LEC-10573; JSC-12892)
Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-28774*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
FINAL DESIGN SPECIFICATION FOR EOD-LARSYS/STATISTICS AND DATA TRANSFORMATION PROCESSORS MODIFICATION
Cheevon Bo-Linn, Principal Investigator Mar. 1978 325 p ERTS
(Contract NAS9-15200)
(E80-10173; NASA-CR-160630; LEC-12030; JSC-13921) Avail: NTIS HC A14/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28775*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR EOD-LARSYS PROCEDURE 1
B. E. Wills, C. T. Gardner, and P. J. Aucoin, Jr., Principal Investigators Oct. 1977 307 p ERTS
(Contract NAS9-15200)
(E80-10174; NASA-CR-160626; LEC-11293; JSC-13143) Avail: NTIS HC A14/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28776*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR LACIE PHASE 3 AUTOMATIC STATUS AND TRACKING SYSTEM
D. L. Smith, J. L. Allison, J. M. Everette, and C. C. DeValcourt, Principal Investigators Jun. 1977 158 p ERTS
(Contract NAS9-15200)
(E80-10175; NASA-CR-160672; LEC-10419-Rev-A; JSC-12743-Rev-A) Avail: NTIS HC A08/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28777*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR LARSYS PROCEDURE 1 FOLLOW-ON
P. J. Aucoin, Jr., Principal Investigator Oct. 1977 9 p ERTS
(Contract NAS9-15200)
(E80-10176; NASA-CR-160627; LEC-11298; JSC-13144) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28778*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR EOD-LARSYS/STATISTICS AND DATA TRANSFORMATION PROCESSORS MODIFICATION
Cheevon Bo-Linn, Principal Investigator Oct. 1977 48 p ERTS
(Contract NAS9-15200)
(E80-10177; NASA-CR-160628; LEC-11357; JSC-13665) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28779*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PROGRAM DOCUMENTATION: FINAL DESIGN SPECIFICATION FOR DOT DATA BASE UPDATE DECK CONVERSION PROGRAM (DOTDEC)
Jeannie Gor, Principal Investigator Jul. 1977 29 p ERTS
(Contract NAS9-15200)
(E80-10178; NASA-CR-160647; LEC-10969; JSC-12656) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28780*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
FINAL DESIGN SPECIFICATION FOR ERIPS FIELDS DATA BASE DECK CONVERSION
Cheevon Bo-Linn, Principal Investigator Aug. 1977 41 p ERTS
(Contract NAS9-15200)
(E80-10179; NASA-CR-160646; LEC-10960; JSC-12655) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28781*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DETAILED DESIGN SPECIFICATION FOR THE YIELD ESTIMATION SUBSYSTEM DATA MANAGEMENT SYSTEM (YESDAMS)
T. G. Phillips, R. L. Davenport, R. F. Hansen, and K. F. Williams, Principal Investigators Jul. 1977 107 p ERTS
(Contract NAS9-15200)
(E80-10180; NASA-CR-160623; LEC-11110; JSC-13064) Avail: NTIS HC A06/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28782*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
MODIFICATIONS TO THE CLASY PROGRAM
B. McCray, Principal Investigator Apr. 1977 102 p ERTS
(Contract NAS9-15200)
(E80-10181; NASA-CR-160673; LEC-10481; JSC-12602) Avail: NTIS HC A06/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28783*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
PROGRAM DOCUMENTATIONS: MARQTY1.FTN, CAMDATA1.FTN
M. A. Mendlowitz, Principal Investigator Aug. 1978 25 p ERTS
(Contract NAS9-15200)
(E80-10182; NASA-CR-160593; LEC-12376) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28784*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR DOT DATA BASE UPDATE DECK CONVERSION PROGRAM (DOTDEC)
Jeannie Gor, Principal Investigator Jun. 1977 8 p ERTS
(Contract NAS9-15200)
(E80-10183; NASA-CR-160681; LEC-10790; JSC-12958) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28785*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR PRODUCTION FILM CONVERTER GAINS AND BIASES PROGRAM (PFCGAB)
C. T. Gardner, Principal Investigator Nov. 1977 182 p ERTS
(Contract NAS9-15200)
(E80-10184; NASA-CR-160638; LEC-11678; JSC-13822) Avail: NTIS HC A09/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28786*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LACIE/PHASE 3 ADJUSTABLE CROP CALENDAR (ACC) CONFIGURATION CONTROL PROCEDURES MANUAL
K. Williams, Principal Investigator Jun. 1977 16 p ERTS
(Contract NAS9-15200)
(E80-10186; NASA-CR-160682; LEC-10800; JSC-12963) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28787*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
RECOMMENDATIONS AND COMMENTS CONCERNING DOCUMENTATION ON THE MICROWAVE ACTIVE SPECTROMETER SYSTEMS
W. A. Rosenkranz and D. P. Pounds, Principal Investigators Jun. 1977 127 p refs ERTS
(Contract NAS9-15200)
(E80-10187; NASA-CR-160679; LEC-10715; JSC-12946) Avail: NTIS HC A07/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28788*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
FUNCTIONAL DESIGN SPECIFICATION FOR ENHANCEMENT OF THE AUTOMATIC STATUS AND TRACKING SYSTEM SOFTWARE
D. K. McCarley, J. M. Everette, and K. P. Eckel, Principal Investigators Sep. 1977 60 p ERTS
(Contract NAS9-15200)
(E80-10190; NASA-CR-160624; LEC-11199; JSC-13110) Avail: NTIS HC A04/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28789*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
A DISCRIMINANT APPROACH TO PARAMETER ESTIMATION IN THE LINEAR MODEL WITH UNKNOWN VARIANCE-COVARIANCE MATRIX
C. R. Hallum (NASA. Johnson Space Flight Center) and M. D. Pore, Principal Investigators 1977 10 p refs Presented at the Ann. Meeting of the Am. Statist. Assoc., Chicago, 15-18 Aug. 1977 ERTS
(Contract NAS9-15200)
(E80-10192; NASA-CR-160676; LEC-10532; JSC-13036) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28790*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LACIE FIELD MEASUREMENTS DATA ACQUISITION SUMMARY REPORT, 1975 - 1976 CROP YEAR
Jan. 1977 29 p ERTS
(Contract NAS9-15200)
(E80-10193; NASA-CR-160645; LEC-9970; JSC-11882) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28791*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
USER'S GUIDE: LARGE AREA CROP INVENTORY EXPERIMENT (LACIE) PHASE 3 PDP 11/45 AUTOMATIC STATUS AND TRACKING SYSTEM
C. C. deValcourt, Principal Investigator Jun. 1977 49 p ERTS
(Contract NAS9-15200)
(E80-10194; NASA-CR-160642; LEC-10148-Rev-A; JSC-12535-Rev-A) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28792*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
A STATISTICAL TEST PROCEDURE FOR DETECTING MULTIPLE OUTLIERS IN A DATA SET
R. S. Chhikara, Principal Investigator and A. H. Feiveson Nov. 1978 18 p refs ERTS
(Contract NAS9-15200)
(E80-10195; NASA-CR-160599; LEC-12910; JSC-14594) Avail: NTIS HC A02/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28793*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION OF THE CAMS/CAS INTERFACE TAPE REPORT GENERATION PROGRAM FOR LACIE 6A
W. A. Holley, Principal Investigator Oct. 1977 63 p ERTS
(Contract NAS9-15200)
(E80-10196; NASA-CR-160625; LEC-11292; JSC-13142) Avail: NTIS HC A04/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28794*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN FOR ENHANCEMENT OF THE AUTOMATIC STATUS AND TRACKING SYSTEM SOFTWARE
D. K. McCarley, Principal Investigator and L. D. Dornell Feb. 1978 146 p ERTS
(Contract NAS9-15200)
(E80-10197; NASA-CR-160631; LEC-11882; JSC-13894) Avail: NTIS HC A07/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-28795*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR HISTORICAL DAILY DATA BASES FOR TESTING ADVANCED MODELS
B. Jeun and K. Williams, Principal Investigators Jan. 1978 76 p ERTS
(Contract NAS9-15200)
(E80-10198; NASA-CR-160675; LEC-10572-Rev-A; JSC-12891-Rev-A) Avail: NTIS HC A05/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28796*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DESIGN SPECIFICATION FOR LARSYS PROCEDURE 1
B. E. Wills, C. T. Gardner, and P. J. Aucoin, Jr., Principal Investigators Apr. 1977 145 p ERTS
(Contract NAS9-15200)
(E80-10199; NASA-CR-160671; LEC-10417; JSC-12742) Avail: NTIS HC A07/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28797*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AS-BUILT DESIGN SPECIFICATION FOR PDP 11/45 ACCURACY ASSESSMENT SYSTEM
C. W. Ahlers, Principal Investigator Dec. 1977 190 p ERTS
(Contract NAS9-15200)
(E80-10200; NASA-CR-160632; LEC-11358-Rev-A; JSC-13666-Rev-A) Avail: NTIS HC A09/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-28798*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIO INTERFEROMETRY: TECHNIQUES FOR GEODESY
Jul. 1980 474 p refs Conf. held in Cambridge and Westford, Mass., 19-21 Jun. 1979
(NASA-CP-2115) Avail: NTIS HC A20/MF A01 CSCL 08E
Progress in the development and application of radio interferometry as a tool for geophysical research is reported and discussed. Among the topics reviewed are: Surveys of is the Seventies, Movements, Terrestrial and Celestial, Degrees Kelvin and Degrees of Phase, the Mark 3 VLBI System, Waves of the Future and other Emissions, and Adherence and Coherence in Networks, and Plans. For individual titles, see N80-28799 through N80-28846.

N80-28799*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

GEODETIC MEASUREMENTS WITH A MOBILE VLBI SYSTEM
Arthur E. Niell, E. Scott Claflin, T. G. Lockhart, Peter F. MacDoran, D. D. Morabito, K. M. Ong, and George M. Resch *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 3-7 (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 08E

The Project ARIES 9 meter transportable antenna was used as one element of very long baseline interferometer (VLBI) to begin monitoring locations of six sites in California relative to large diameter fixed antennas at the NASA Deep Space Network, Goldstone, California, and at the Caltech Owens Valley Radio Observatory, Big Pine, California. An accuracy of about 6 cm in the horizontal components was demonstrated by comparison with measurements of the National Geodetic Survey. The root of mean square scatter of the lengths of the baselines between any pair of antennas was about 3 cm except for the Goldstone-JPL (Pasadena) baseline. In the period August 1974 to August 1977 the length of this baseline increased by 15 + or - 5 cm as JPL moved westward relative to Goldstone at the rate of 6 + or - 2 cm/year. The baseline lengths were unaffected by the uncertainties of UT1, polar motion, and tropospheric water vapor, which are the limitations to present three dimensional vector accuracies. R.E.S.

N80-28800*# National Geodetic Survey, Rockville, Md.
NOS/NGS ACTIVITIES TO SUPPORT DEVELOPMENT OF RADIO INTERFEROMETRIC SURVEYING TECHNIQUES
William E. Carter, J. F. Dracup, L. D. Hothem, Douglas S. Robertson, and W. E. Strange *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 9-22 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

National Geodetic Survey activities towards the development of operational geodetic survey systems based on radio interferometry are reviewed. Information about the field procedures, data reduction and analysis, and the results obtained to date is presented. R.E.S.

N80-28801*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LONG BASELINE VECTOR DETERMINATIONS AND INTERCOMPARISONS
Curtis A. Knight (Northeast Radio Observatory Corp., Westford Mass. Haystack Observatory) *In its* Radio Interferometry Jul. 1980 p 23-26 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

The East Coast very long baseline interferometry (VLBI) group has performed about 60 experiments over the last 10 years in the process of developing and exploiting advanced VLBI techniques. Of those, the most recent 14 experiments are briefly described. R.E.S.

N80-28802*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POLAR MOTION AND UT1: COMPARISON OF VLBI, LUNAR LASER, SATELLITE LASER, SATELLITE DOPPLER, AND CONVENTIONAL ASTROMETRIC DETERMINATIONS
Douglas S. Robertson, Thomas A. Clark, Robert J. Coates, Chopo Ma, James W. Ryan, Brian E. Corey, Charles C. Counselman, III, Robert W. King, Irwin I. Shapiro, Hans F. Hinteregger et al *In its* Radio Interferometry Jul. 1980 p 33-44 ref Prepared in cooperation with National Geodetic Survey, Rockville, Md., MIT, Cambridge, Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory and Computer Sciences Corp., Greenbelt, Md. (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

Very long baseline interferometry observations made with a 3900 km baseline interferometer (Haystack Observatory in Massachusetts to Owens Valley Observation in California) were used to estimate changes in the X-component of the position of the Earth's pole and in UT1. These estimates are compared with corresponding ones from lunar laser ranging, satellite laser ranging, satellite Doppler, and stellar observations. R.E.S.

N80-28803*# Naval Research Lab., Washington, D. C.
A REVIEW OF CONNECTED ELEMENT RADIO INTERFEROMETRY DIRECTED AT ESTABLISHING AN ALMOST INTERNAL REFERENCE FRAME
Kenneth J. Johnston *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 45-61 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 03A

The present status of connected element radio interferometry towards establishing an accurate grid of positions of extragalactic radio sources is reviewed. Many of the problems being encountered are, in general, also faced by very long baseline interferometry. Author

N80-28804*# Naval Observatory, Washington, D. C.
THE USNO/NRL GREEN BANK INTERFEROMETER PROGRAM Progress Report
William J. Klepczynski, George H. Kaplan (Naval Research Lab., Washington, D.C.), D. D. McCarthy, F. J. Josties, R. L. Branham, Kenneth J. Johnston (Naval Research Lab., Washington, D.C.), and John S. Spencer *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 63-70 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

Application of the connected-element radio interferometer of the National Radio Astronomy Observation in Green Bank, West Virginia to the determination of improved source coordinates, astronomical constants, and variations in Earth rotation parameters is discussed. It is concluded that because of the brevity and discontinuity of the data so far no reliable conclusions regarding the accuracy of the data can be drawn. R.E.S.

N80-28805*# York Univ., Toronto (Ontario). Dept. of Physics.
GEODETIC LONG BASELINE INTERFEROMETRY RESEARCH IN CANADA
R. B. Langley (MIT, Cambridge), William T. Petrachenko, and Wayne H. Canon *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 71-87 refs Sponsored in part by National Research Council of Canada (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

The objectives and results of several studies using the Canadian long baseline interferometry system (LBI) are presented. The precision of measurements from radio telescopes at the Algonquin Radio Observatory (ARO), Lake Traverse, Ontario; the Owens Valley Radio Observatory (OVRO), Big Pine, California; and the Chilbolton Observatory (CHIL), Chilbolton, England, is discussed. Also, since LBI is insensitive to the uncertainty in the geocentric gravitational constant, it is a very useful technique for determining the scales of the coordinate systems used by other precise techniques. Beginning in May 1977, a number of LBI observing sessions were accompanied by simultaneous satellite Doppler observations. The baseline components obtained from the satellite Doppler observations were compared to the LBI values. The weighted mean scale bias of the NSWC 9Z-2 satellite Doppler coordinate system relative to the LBI system was found to be 0.42 + or - 0.05 PPM. The weighted mean difference in the origin of longitude was found to be 0.87 sec + or - 0.01 while the difference in declination origin was found to be 0.06 sec + or - 0.01. R.E.S.

N80-28806*# Naval Research Lab., Washington, D. C.
PHASE COHERENT VLBI USING A SATELLITE LINK
William B. Waltman, S. H. Nkowles, J. L. Yen (Toronto Univ.), D. N. Fort (Herzberg Inst. of Astrophysics, Ottawa, Ontario), G. W. Swenson, Jr. (Illinois Univ.), Wayne H. Cannon (York Univ., Toronto, Ontario), and John Galt (Herzberg Inst. of Astrophysics, Penticton, British Columbia) *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 89-94 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

The results from experiments using the Hermes (formerly CTS) communications satellite to provide a local oscillator and data link between two antennas are presented. The techniques used to compensate for the satellite motion and translation oscillator are described. Plans for a series of three station experiments to measure UT and polar motion using the ANIK-B satellite to synchronize the local oscillators are discussed. R.E.S.

N80-28807*# Uppsala Univ. (Sweden). Inst. of Geophysics.
SCANDINAVIA STUDIES OF RECENT CRUSTAL MOVEMENTS AND THE SPACE GEODETIC BASELINE NETWORK
Allen Joel Anderson *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 97-106 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

A brief review of crustal movements within the Fenno-Scandia shield is given. Results from postglacial studies, projects for measuring active fault regions, and dynamic ocean loading experiments are presented. The 1979 Scandinavian Doppler Campaign Network is discussed. This network includes Doppler translocation baseline determination of future very long baseline interferometry baselines to be measured in Scandinavia. Intercomparison of earlier Doppler translocation measurements with a high precision terrestrial geodetic baseline in Scandinavia has yielded internal agreement of 6 cm over 887 km. This is a precision of better than 1 part in to the 7th power. R.E.S.

N80-28808*# York Univ., Toronto (Ontario). Dept. of Physics.
THE MEASUREMENT OF EARTH ROTATION ON A DEFORMABLE EARTH
Wayne H. Cannon *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 109-144 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

Until recently, the methods of geodetic positioning on the Earth were limited to a precision of roughly one part in 10 to the 6th power. At this level of precision, the Earth can be regarded as a rigid body since the largest departure of the Earth from rigidity is manifested in the strains of the Earth tides which are of the order of one part in 10 to the 7th power. Long baseline interferometry is expected to routinely provide global positioning to a precision of one part in 10 to the 8th power or better. At this level of precision, all parts of the Earth's surface must be regarded as being, at least potentially, in continual motion relative to the geocenter as a result of a variety of geophysical effects. The general implications of this phenomenon for the theory of the Earth's rotation is discussed. Particular attention is given to the question of the measurement of the 'Earth's rotation vector' on a deformable Earth. R.E.S.

N80-28809*# New South Wales Univ., Sydney (Australia). School of Surveying.
CRUSTAL DEFORMATION AT VERY LONG BASELINE INTERFEROMETRY SITES DUE TO SEASONAL AIR-MASS AND GROUND WATER VARIATIONS
A. Stolz and Douglas R. Larden (Colorado Univ., Boulder) *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 145-151 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

The seasonal deformation normal to the Earth's surface was calculated at stations involved or interested in very long baseline interferometry (VLBI) geodesy and at hypothetical sites in Australia and Brazil using global atmospheric pressure data, values for groundwater storage, and load Love numbers deduced from current Earth models. It was found that the annual range of deformation approached the centimeter level measuring potential of the VLBI technique at Greenbank, Haystack, and the Brazil site. R.E.S.

N80-28810*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GEOPHYSICAL AND ASTRONOMICAL MODELS APPLIED IN THE ANALYSIS OF VERY LONG BASELINE INTERFEROMETRY
Chopo Ma, James W. Ryan, and Bruce R. Schupler (Computer Sciences Corp., Greenbelt, Md.) *In its* Radio Interferometry Jul. 1980 p 153-159 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

Very long baseline interferometry presents an opportunity to measure at the centimeter level such geodetic parameters as baseline length and instantaneous pole position. In order to achieve such precision, the geophysical and astronomical models used in data analysis must be as accurate as possible. The Mark-3 interactive data analysis system includes a number of refinements beyond conventional practice in modeling precession, nutation, diurnal polar motion, UT1, solid Earth tides, relativistic light deflection, and reduction to solar system barycentric coordinates. The algorithms and their effects on the recovered geodetic, geophysical, and astrometric parameters are discussed. R.E.S.

N80-28811*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VLBI MEASUREMENTS OF RADIO SOURCE POSITIONS AT THE JET PROPULSION LABORATORY
George H. Purcell, Jr., John L. Fanselow, J. B. Thomas, E. J. Cohen, David H. Rogstad, O. J. Sovers, L. J. Skjerve, and D. J. Spitzmesser *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 165-172 refs (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 03A

The results of approximately 1300 observations of 67 radio sources are presented. Most of the measurements were made at the stations of the Deep Space Network in California, Spain, and Australia at wavelengths of 13.1 and 3.6 cm, between 1971 and 1978. The formal errors in the derived source positions are generally in the neighborhood of 0.01 seconds of arc and the positions agree fairly well with those previously published. E.D.K.

N80-28812*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A VERY LONG BASELINE INTERFEROMETRY SKY SURVEY **c53**
Robert A. Preston and D. D. Morabito *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 173-179 refs (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 08E

A systematic very long baseline interferometry (VLBI) sky survey, undertaken to find a suitable set of compact celestial radio sources from which a more complete VLBI reference frame can be constructed, discussed. The survey was conducted by searching known celestial radio sources for compact components by means of VLBI observations. Baseline lengths were about 7 x 10 to the 7th power RF wavelengths (lambda = 13.1 cm), so the spatial wavelengths being sampled by the interferometer were generally on the order of a few milliarcseconds. Hence, the radio sources detected have a measurable portion of their total flux density contained in components that are no more than a few milliarcseconds in angular extent. Existing information of radio sources were used as clues to source size. E.D.K.

N80-28813*# Naval Research Lab., Washington, D. C.
ASTRONOMY USING BASIC MARK 2 VERY LONG BASELINE INTERFEROMETRY
John H. Spencer, William B. Waltman, Kenneth J. Johnston, and D. C. Backer (California Univ., Berkeley) *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 181-186 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 03A

Two experiments were performed in April and September 1976 to determine precise positions of radio sources using conventional Mark 2 VLBI techniques. Four stations in the continental United States observed at a wavelength of 18 cm. The recording bandwidth was 2 MHz. The preliminary results using analyses of fringe rate and delay are discussed and the source positions compared with the results of other measurements. E.D.K.

N80-28814*# California Univ., Berkeley. Radio Astronomy Lab.
DIFFERENTIAL RADIO ASTRONOMY OF GALACTIC OBJECTS
D. C. Backer *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 187-192 ref (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 03A

A differential astrometry technique is discussed. An improved

proper motion and a parallax limit for pulsar 1929 + 10 is presented as well as a limit on the space velocity of the enigmatic object in SgrA. E.D.K.

N80-28815*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
SOURCE STRUCTURE CORRECTIONS TO THE GEODETIC VERY LONG BASELINE INTERFEROMETRY OBSERVABLES
William D. Cotton *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 193-197 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

Why source structure affects VLBI observations and how source structure corrupts the geodetic observables are discussed. Evidence is presented which shows that corrections for source structure are possible and necessary for centimeter level accuracy VLBI measurements. E.D.K.

N80-28816*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
HYDROGEN MASER FREQUENCY STANDARD
Robert F. C. Vessot *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 203-221 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 20E

The fundamental theoretical limitations of the maser, systematic processes that cause instability, and some aspects of recently designed masers are described. A design for field use that has evolved from the development of the space borne maser is presented. The performance of this type of maser is close to theoretical limits imposed by thermal noise. Further developments of smaller masers for space and terrestrial use and recent work on masers operating at low temperatures is also discussed. E.D.K.

N80-28817*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE PERFORMANCE OF NASA RESEARCH HYDROGEN MASERS
Victor S. Reinhardt and Lauren J. Rueger (APL, Laurel, Md.) *In its* Radio Interferometry Jul. 1980 p 223-240 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 20E

Field operable hydrogen masers based on prior maser designs are presented. These units incorporate improvements in magnetic shielding, lower noise electronics, better thermal control, and have a microprocessor for operation, monitoring, and diagnostic functions. They are ruggedly built for transportability and ease of service anywhere in the world. E.D.K.

N80-28818*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ULTRA-LOW-NOISE MICROWAVE AMPLIFIERS
Robert C. Clauss and David L. Trowbridge *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 241-254 refs (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 09A

The highlights of 20 years of maser use and development are presented. Masers discussed include cavity, traveling wave, K band, and S band. Noise temperatures measured since 1960 are summarized. Use of masers in the Deep Space Network is presented. Costs associated with the construction of masers systems are given. E.D.K.

N80-28819*# Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory.
PHASE AND GROUP DELAY CALIBRATION OF A VERY LONG BASELINE INTERFEROMETER BY EAST COAST VLBI GROUP
Alan E. E. Rogers *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 255-261 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 14B

Precisely timed pulses injected into the input of each receiver are used to calibrate the phase and group delay through each interferometer terminal. The short duration pulses are generated at a 1 MHz rate directly from the output of the frequency standard. The pulses are injected into the receiver at a level low enough to produce less than one percent increase in system temperature, yet can be extracted during processing with a high enough signal to noise ratio to determine the phase of the calibration rails within 1 degree in 1 second of integration. The calibration system also includes precise cable measurement electronics and a pulse echo for clock synchronization. E.D.K.

N80-28820*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
USE OF A DIGITAL TONE EXTRACTOR FOR REAL-TIME PHASE ANALYSIS
Elliott Sigman and Gary S. Parks *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 263-267 (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 14B

A digital tone extractor which monitors the phase integrity of a VLBI recording system in real time was developed. The digital tone extractor monitors phase calibrator tones injected at the antenna and tracks their phase as a function of time. It is capable of maintaining 0.001 cycle phase accuracy over the course of a VLBI experiment in accordance with the accuracy requirements of centimeter VLBI work. This real time VLBI system monitor is a safeguard against most instrumental breakdowns and operator errors. E.D.K.

N80-28821*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONSIDERATIONS IN THE PLACEMENT OF PHASE CALIBRATION TONES
Lawrence E. Young *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 269-274 (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 14B

In the use of tones to calibrate unwanted instrumental phases for very long baseline interferometry experiments, certain problems exist which are related to the placement of these phase calibrator tones. (1) A bias exists in an analytically generated stopping function used during correlation if its frequency satisfies the following condition: f = (f sub s)x(m)/n, where f sub s = sampling frequency, m = any integer, and n = any odd integer. (2) Due to the quantized representation of sine waves in the stopping function, odd harmonics of the fundamental frequencies are generated. Several mechanisms are available through which these harmonics can cause errors in the residual phase extracted from the recorded tones. (3) When multiple tones are injected into a pass band, intermodulation products can occur. The magnitude of these effects is discussed along with strategies designed to avoid them. E.D.K.

N80-28822*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SENSITIVITY OF A VERY LONG BASELINE INTERFEROMETER
Alan E. E. Rogers (Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory) *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 275-281 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 14B

The theoretical sensitivity of various methods of acquiring and processing interferometer data are compared. It is shown that for a fixed digital recording capacity one bit quantization of single sideband data filtered with a rectangular bandpass and sampled at the Nyquist rate yields the optimum signal to noise ratio. The losses which result from imperfect bandpass, poor image rejection, approximate methods of fringe rotation, fractional bit correction, and loss of quadrature are discussed. Also discussed is the use of the complex delay function as a maximum likelihood fringe estimator. Author

N80-28823*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MARK 3 SYSTEM OVERVIEW
T. A. Clark *In its* Radio Interferometry Jul. 1980 p 285-290 refs (For primary document see N80-28798 19-43)

Avail: NTIS HC A20/MF A01 CSCL 08E

The Mark 3 very long baseline interferometry (VLBI) system, comprising a complete end to end VLBI system optimized for both high accuracy geodesy and radio astronomy, is described. The data flow, the data base handler system, and the field station component and configurations are briefly discussed. The use of mobile and transportable stations allows measurements to be taken from a large number of sites with relatively few sets of equipment. Fixed stations form a long term reference network for tying together the measurements with the mobile and transportable stations. M.G.

N80-28824*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AUTOMATION OF THE MARK 3 FIELD SYSTEM

N. R. Vandenberg, T. A. Clark, L. N. Foster (Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory), A. R. Whitney, and G. Lampe *In its* Radio Interferometry Jul. 1980 p 291-295 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 14B

The software and hardware components which will enable hands off operation are described. The operation of the field system begins with the scheduling of observations. An interactive program, SKED, provides displays of mutual visibility, automatic calculation of telescope slewing times, and the ability to list and edit the schedule. The output of SKED is a schedule file containing commands in the Standard Notation for Astronomy Procedures (SNAP) language which the field system uses for controlling events during the experiment. The most important features of SNAP include sophisticated time sequencing of events, automatic logging of all commands and responses, and the ability to define often used sequences of commands as procedures. A control program, BOSS, running in an HP 1000 minicomputer, reads the SNAP commands from a schedule file and interprets them in terms of commands and requests to devices. Interactive command input is possible through the operator's display terminal. Communication with all of the Mark 3 electronics modules is done via a small general purpose interface board (a microprocessor based ASCII transceiver) which has been installed in each module. Additional devices are controlled and monitored using the IEEE 488 General Purpose Interface Bus. M.G.

N80-28825*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MICROWAVES TO MEGABITS

A. E. E. Rogers (Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory) *In its* Radio Interferometry Jul. 1980 p 297-304 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 14B

Receiver and terminal characteristics of the Mark 3 very long baseline interferometry system are described in some detail. The Mark 3 system has 14 IF to video converters, each with built in synthesized local oscillators which have a range of 100 to 500 MHz covered in 10 kHz steps. In the normal wideband continuum mode, all 14 upper and all 14 lower sideband video outputs (each with 2 MHz bandwidth) are recorded with a total data rate of 112 Mbits/sec. In geodetic observations, two IF bands are simultaneously recorded from a dual band (S/X) receiver. M.G.

N80-28826*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MARK 3 WIDEBAND DIGITAL RECORDER IN PERSPECTIVE

Hans F. Hinteregger (Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory) *In its* Radio Interferometry Jul. 1980 p 305-316 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 14E

The tape recorder used for the Mark 3 data acquisition and processing system is compared with earlier very long baseline interferometry recorders. Wideband 33-1/3 kbpi digital channel characteristics of instrumentation recorders and of a modern video cassette recorder are illustrated. Factors which influenced selection of the three major commercial components (transport, heads, and tape) are discussed. A brief functional description and the reasons for development of efficient signal electronics and necessary auxiliary control electronics are given. The design and operation of a digital bit synchronizer is illustrated as an example of the high degree of simplicity achieved. M.G.

N80-28827*# Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory.

MARK 3 CORRELATOR HARDWARE AND SOFTWARE

Alan R. Whitney *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 317-325 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 14B

The Mark 3 correlator system is described in some detail. The correlator system is based on a modular philosophy. Each correlator module independently processes the data from one track pair. Therefore, 28 modules are necessary to complete a full one baseline processor and 84 modules for a full 3 baseline processor. Each correlator module has two interfaces: (1) data and clock from each of the two tracks to be correlated and (2) Computer Automated Measurement and Control (CAMAC) dataway interface to the computer. The processor is organized around the IEEE CAMAC standard architecture, housing 15 correlator modules in each of 6 crates. This allows one pass processing of a full 3 baseline 28 track observation or a 6 baseline (4 station) 14 track observation. The correlator architecture allows easy expansion for up to 8 stations. The computer system is an HP 1000 system utilizing a 16 bit minicomputer with disc and tape peripherals. The processing software is also organized in a modular fashion with many independent but cooperative programs controlling the operation of the Mark 3 processor. Processing time through the correlator is normally real time or faster, with graphics displays providing real time monitor and control of the processing operation. M.G.

N80-28828*# Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory.

CORRELATOR COMPUTER INTERFACE AND MODULE IMPLEMENTATION: MARK 3 PROCESSOR

Edwin F. Nesman *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 327-328 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 09B

Two hardware aspects of the Mark 3 correlator are briefly described. The first area concerns the choice of interface to the controlling minicomputer and the second area concerns the implementation of the correlator module. Multiple computer automated measurement and control (CAMAC) modules and a single large CAMAC module were considered as possible packaging forms for the correlator. The large CAMAC module approach was chosen because of the difficulty in partitioning the correlator with minimum interconnections, the fabrication economy of a single large planar assembly, and the desire to minimize the number of modules. M.G.

N80-28829*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

MARK 3 VLBI SYSTEM: TROPOSPHERIC CALIBRATION SUBSYSTEMS

G. M. Resch *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 329-332 (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 14B

Tropospheric delay calibrations are implemented in the Mark 3 system with two subsystems. Estimates of the dry component of tropospheric delay are provided by accurate barometric data from a subsystem of surface meteorological sensors (SMS). An estimate of the wet component of tropospheric delay is provided by a water vapor radiometer (WVR). Both subsystems interface directly to the ASCII Transceiver bus of the Mark 3 system and are operated by the control computer. Seven WVR's under construction are designed to operate in proximity to a radio telescope and can be commanded to point along the line-of-sight to a radio source. They should provide a delay estimate that is accurate to the + or - 2 cm level. M.G.

N80-28830*# Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory.

MARK 3 REAL-TIME FRINGE DETECTION SYSTEM

J. I. Levine and A. R. Whitney *In* NASA. Goddard Space

Flight Center Radio Interferometry Jul. 1980 p 333-336 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 14B

A RAM memory built into the Mark 3 decoder module allows the capture of 1 Megabit of data. Data may be collected either in real time or from a pre-recorded tape. Once collected, the data may be retrieved using a standard EIA serial data link. The data may be transmitted to a remote computer for cross correlation processing with similar data from other stations to verify fringes in real time. The data may also be analyzed by a local computer to verify phase calibration, bandpass, format, etc., during a Mark 3 observing session. Author

N80-28831*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MARK 3 DATA BASE HANDLER
James W. Ryan, Chopo Ma, and Bruce R. Schupler (Computer Sciences Corp., Greenbelt, Md.) *In its* Radio Interferometry Jul. 1980 p 337-346 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 05B

A data base handler which would act to tie Mark 3 system programs together is discussed. The data base handler is written in FORTRAN and is implemented on the Hewlett-Packard 21MX and the IBM 360/91. The system design objectives were to (1) provide for an easily specified method of data interchange among programs, (2) provide for a high level of data integrity, (3) accommodate changing requirments, (4) promote program accountability, (5) provide a single source of program constants, and (6) provide a central point for data archiving. The system consists of two distinct parts: a set of files existing on disk packs and tapes; and a set of utility subroutines which allow users to access the information in these files. Users never directly read or write the files and need not know the details of how the data are formatted in the files. To the users, the storage medium is format free. A user does need to know something about the sequencing of his data in the files but nothing about data in which he has no interest. M.G.

N80-28832*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MARK 3 INTERACTIVE DATA ANALYSIS SYSTEM
James W. Ryan, Chopo Ma, and Bruce P. Schupler (Computer Sciences Corp., Beltsville, Md.) *In its* Radio Interferometry Jul. 1980 p 347-353 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 05B

The interactive data analysis system, a major subset of the total Mark 3 very long baseline interferometry (VLBI) software system is described. The system consists of two major and a number of small programs. These programs provide for the scientific analysis of the observed values of delay and delay rate generated by the VLBI data reduction programs and product the geophysical and astrometric parameters which are among the ultimate products of VLBI. The two major programs are CALC and SOLVE. CALC generates the theoretical values of VLBI delay rate as well as partial derivatives based on apriori values of the geophysical and astronometric parameters. SOLVE is a least squares parameters estimation program which yields the geophysical and astrometric parameters using the observed values by the data processing system and theoretical values and partial derivatives provided by CALC. SOLVE is a highly interactive program in which the user selects the exact form of the recovered parameters and the data to be accepted into the solution. M.G.

N80-28833*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
WATER VAPOR AS AN ERROR SOURCE IN MICROWAVE GEODETIC SYSTEMS: BACKGROUND AND SURVEY OF CALIBRATION TECHNIQUES
E. S. Claflin and G. M. Resch *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 357-361 (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 08E

Water vapor as an error source in radio interferometry systems is briefly examined. At microwave frequencies, the delay imposed by tropospheric water vapor becomes a limiting error source for high accuracy geodetic systems. The mapping of tropospheric induced errors into 'solved-for' parameters depends upon baseline length and observing strategy. Simulation analysis (and experience) indicates that in some cases, errors in estimating tropospheric delay can be magnified in their effect on baseline components. The various techniques by which tropospheric water can be estimated or measured are surveyed with particular consideration to their possible use as a calibration technique in support to very long baseline interferometry experiments. The method of remote sensing using a microwave radiometer seems to be the most effective way to provide an accurate estiamte of water vapor delay. M.G.

N80-28834*# Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
THE ESTIMATION OF THE PROPAGATION DELAY THROUGH THE TROPOSPHERE FROM MICROWAVE RADIOMETER DATA
J. M. Moran and B. R. Rosen *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 363-376 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 09F

The uncertainity in propagation delay estimates is due primarily to tropospheric water, the total amount and vertical distribution of which is variable. Because water vapor both delays and attenuates microwave signals, the propagation delay, or wet path length, can be estimated from the microwave brightness temperature near the 22.235 GHz transition of water vapor. The data from a total of 240 radiosonde launches taken simultaneously were analyzed. Estimates of brightness temperature at 19 and 22 GHz and wet path length were made from these data. The wet path length in the zenith direction could be estimated from the surface water vapor density to an accuracy of 5 cm for the summer data and 2 cm for winter data. Using the brightness temperatures, the wet path could be estimated to an accuracy of 0.3 cm. Two dual frequency radiometers were refurbished in order to test these techniques. These radiometers were capable of measuring the difference in the brightness temperature at 30 deg elevation angle and at the zenith to an accuracy of about 1 K. In August 1975, 45 radiosondes were launched over an 11 day period. Brightness temperature measurements were made simultaneously at 19 and 22 GHz with the radiometers. The rms error for the estimation of wet path length from surface meteorological parameters was 3.2 cm, and from the radiometer brightness temperatures, 1.5 cm. M.G.

N80-28835*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MICROWAVE RADIOMETRY AS A TOOL TO CALIBRATE TROPOSPHERIC WATER-VAPOR DELAY
G. M. Resch and E. S. Claflin *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 377-384 refs (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 09F

Microwave radiometers were used to measure the emission line due to the water vapor molecules of atmospheric emission. Four separate field tests were completed which compared radiometers to other techniques which measure water vapor. It is shown that water vapor induced delay can be estimated with an accuracy of plus or minus 2 cm for elevation angles above 17 degrees. R.C.T.

N80-28836*# Bonn Univ. (West Germany). Geodetic Inst.
PHASE VERSUS DELAY IN GEODETIC VLBI
James Campbell *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 385-397 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

The conditions for the applicability of the phase observable in very long baseline interferometry are discussed and examples of adequate observation programs are given. These considerations apply in particular to the Mark 2 system, which is already in operation at many observatories. R.C.T.

N80-28837*# Massachusetts Inst. of Tech., Cambridge.
PHASE DELAY ASTROMETRY AND ITS GEODETIC APPLICATIONS
J. J. Wittels *In* NASA. Goddard Space Flight Center Radio

Interferometry Jul. 1980 p 399-402 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

The accuracy inherent in the fringe phase in the determination of source positions was calculated. It is shown that accuracy can be utilized by applying differencing techniques in order to circumvent such systematic effects as clock drift and delay due to the propagation media. R.C.T.

N80-28838*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE EMISSION RADIO INTERFEROMETRIC EARTH SURVEYING (SERIES)
P. F. MacDoran *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 403-408 (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 08B

Existing satellite radio emissions of the global positioning system were exploited as a resource for cost effective high accuracy geodetic measurements. System applications were directed toward crustal dynamics and earthquake research. R.C.T.

N80-28839*# Massachusetts Inst. of Tech., Cambridge.
BACKPACK VLBI TERMINAL WITH SUBCENTIMETER CAPABILITY
C. C. Counselman, III, I. I. Shapiro (Draper (Charles Stark) Lab., Inc.), R. L. Greenspan, and D. B. Cox, Jr. (Draper (Charles Stark) Lab., Inc.) *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 409-414 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

Backpack portable equipment was developed to measure vector baseline from approximately 1 km to 100 km in length with subcentimeter to few centimeter accuracy. The equipment design features as well as the instrumentation specifications are discussed. It is shown that the unit has the following advantages: it is simple in concept; it is reliable in unattended operation; and it is inexpensive (less than $15,000 per unit). R.C.T.

N80-28840*# Netherlands Foundation for Radio Astronomy, Dwingelo.
THE EUROPEAN VLBI NETWORK
R. T. Schilizzi *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 417-423 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

The capabilities of the European very long baseline interferometry (VLBI) network are summarized. The range of baseline parameters, sensitivities, and recording and other equipment available are included. Plans for upgrading the recording facilities and the use of geostationary satellites for signal transfer and clock synchronization are discussed. R.C.T.

N80-28841*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NASA GEODETIC APPLICATIONS OF THE MARK 3 VLBI SYSTEM
Robert Coates *In its* Radio Interferometry Jul. 1980 p 425-433 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

The Mark 3 very long baseline interferometer system was used in monitoring the following geodetic phenomena: the regional deformation and strain accumulation related to large earthquakes in the plate boundary region of the western United States; contemporary relative plate tectonic motions of the North American, Pacific, South American, Eurasian, and Australian Plates; the internal deformation of continental and oceanic lithospheric plates with particular emphasis on North America and the Pacific; the rotational dynamics of the Earth and their possible correlation to earthquakes, plate motions, and other geophysical phenomena; and motions and deformation occurring in regions of high earthquake activity. R.C.T.

N80-28842*# Ohio State Univ., Columbus. Dept. of Geodetic Science.
ON THE VLBI-SATELLITE LASER RANGING IRON TRIANGLE INTERCOMPARISON EXPERIMENT
Yehuda Bock, Ivan I. Mueller, and Erricos Pavlis *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 435-445 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08B

Simulations were performed to determine the suitability of the proposed station locations. The criterion was a comparison among the possible station configuration of the standard deviations of baseline and Earth rotation parameters estimated from a least squares covariance analysis. Only the relative magnitudes of the standard deviations were addressed in the analysis. Only random errors were assumed and no provision was made for systematic effects. The Iron Triangle, consisting of the stations at Westford (Haystack), Massachusetts, Owens Valley, California, and Ft. Davis, Texas, was regarded as the structure of the proposed network with options to incorporate either the Goldstone, California, or Green Bank, West Virginia, station or both. It was decided to include the Richmond, Florida, station in the analysis since it offered more North-South separation and therefore could strengthen the geometry of the network especially in the recovery of Earth rotation parameters. R.C.T.

N80-28843*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK CAPABILITIES FOR RADIO INTERFEROMETRY
J. L. Fanselow *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 447-450 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 14B

The very long baseline interferometry capability as well as the planned capability of the deep space network (DSN) are described. Major emphasis is placed on the following: VLBI development; operational VLBI for DSN calibration; and VLBI for spacecraft navigation. R.C.T.

N80-28844*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE JET PROPULSION LABORATORY/CALIFORNIA INSTITUTE OF TECHNOLOGY BLOCK 2 VLBI PROCESSOR
D. H. Rogstad *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 451-454 (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 14B

A multistation, multichannel cross correlation processor using the 250 k bit to 4 M bit recording format is discussed. The design is modular, using bit sliced microprocessors to perform the routine calculations for phase and delay on a per station basis, as well as for fractional bit shift correction and Fourier transformation of the correlation coefficients on a per baseline basis. R.C.T.

N80-28845*# National Geodetic Survey, Rockville, Md.
PROJECT POLARIS: A REPORT Status Report
W. E. Carter *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 455-460 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

The project was proposed to meet the developing demands for higher resolution and accuracy polar motion and Earth rotation data to support modern geodynamic studies. The basis for the selection of radio interferometry, rather than lunar or artifical satellite laser ranging or Doppler satellite tracking, is described. R.C.T.

N80-28846*# York Univ., Toronto (Ontario).
PLANS FOR PHASE COHERENT LONG BASELINE INTERFEROMETRY FOR GEOPHYSICAL APPLICATIONS USING THE ANIK-B COMMUNICATIONS SATELLITE
W. H. Cannon, W. T. Petrachenki, J. L. Yen (Toronto Univ.), J. A. Galt, W. B. Waltman, S. H. Knowles (NRL, Washington, D.C.), and J. Popelar (Department of Energy, Mines and Resources, *Ottawa, Canada) In NASA. Goddard Space Flight Center Radio* Interferometry Jul. 1980 p 461-480 refs (For primary document see N80-28798 19-43)
Avail: NTIS HC A20/MF A01 CSCL 08E

A pilot project to establish an operational phase stable very long baseline interferometer (VLBI) for geophysical studies is

described. Methods for implementation as well as practical applications are presented. R.C.T.

N80-28847*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE REMOTE SENSING FACILITY FOR OCEANOGRAHIC APPLICATIONS Final Report
R. H. Evans, S. S. Kent, and J. B. Seidman 1 Jul. 1980 76 p refs
(Contract NAS7-100)
(NASA-CR-163363; JPL-Pub-80-40) Avail: NTIS HC A05/MF A01 CSCL 08C

The project organization, design process, and construction of a Remote Sensing Facility at Scripps Institution of Oceanography at LaJolla, California are described. The facility is capable of receiving, processing, and displaying oceanographic data received from satellites. Data are primarily imaging data representing the multispectral ocean emissions and reflectances, and are accumulated during 8 to 10 minute satellite passes over the California coast. The most important feature of the facility is the reception and processing of satellite data in real time, allowing investigators to direct ships to areas of interest for on-site verifications and experiments. L.F.M.

N80-28848*# National Aeronautics and Space Administration, Washington, D. C.
DESCRIPTION OF TEXTS OF AUXILIARY PROGRAMS FOR PROCESSING VIDEO INFORMATION. PART 2: SUODH PROGRAM OF AUTOMATED SEPARATION OF QUASIHOMOGENEOUS FORMATIONS
V. I. Borisenko and L. S. Chesalin Jun. 1980 13 p refs Transl. into ENGLISH of "Opisaniye i Teksty Vspomogatel'nykh Programm obrabotki Videoinformatsii: Chast 2: Programma SUODH Avtomatizirovannogo Vydeleniya Kvaziodnoroykh Obrazovaniy". Rept. Pr-397 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-15 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76239; Pr-397) Avail: NTIS HC A02/MF A01 CSCL 09B

The algorithm, block diagram, complete text, and instructions are given for the use of a computer program to separate formations whose spectral characteristics are constant on the average. The initial material for operating the computer program presented is video information in a standard color-superposition format. A.R.H.

N80-28849# Lockheed Missiles and Space Co., Palo Alto, Calif.
MULTIDIMENSIONAL TIME DEPENDENT STRUCTURE AND MECHANISMS FOR NON-LTE CO2 INFRARED EMISSIONS AND 4.3 MICROMETERS AURORA Final Report, 1 Jun. 1976 - 31 Jul. 1979
J. B. Kumer 31 Aug. 1979 191 p refs Sponsored in part by DNA
(Contract F19628-76-C-0209)
(AD-A084940; AFGL-TR-79-0224) Avail: NTIS HC A09/MF A01 CSCL 17/5

The effort was concerned with development of a two dimensional time dependent radiation transport model of the CO2 4.3 micrometer aurora. Predictions of spatial structure in auroral nadir radiance, and experimental concepts for verification were addressed. Nadir radiance gradients in the CO2 4.3 micrometer aurora are predicted to be comparable to those in the 2.7 micrometer aurora even though the DC component of the former is approx. 10 times brighter. A rocket borne arc over flown cryogenically cooled tilting etalon spectrometer in series with CO2 absorption cell wheel is shown to be the optimum experiment to provide verification. The modelling facility is also used to estimate the 4.3 micrometer signal levels that might be observed in the electron gun mother-sensor module daughter spatial EXCEDE experiment and to delineate emission mechanisms for that experiment. A detailed investigation of the CO2 4.3 micrometer zenith radiance data obtained under undisturbed night time conditions on 4/11/74 revealed compelling evidence for the existence of an OH airglow related mechanism for producing structured CO2 4.3 micrometer radiance under undisturbed night time conditions. Detailed LWIR CO2 emission earthlimb synthetic spectra that are pumped by structured mechanisms such as aurora, airglow and fluorescence are also presented. GRA

N80-28850# Potomac Research, Inc., Baileys Crossroads, Va.
MAP COORDINATE CONVERSION Final Report, Dec. - Mar. 1978
H. O. Eberhart Mar. 1978 112 p Revised
(Contract DAAK11-77-C-0112)
(AD-A084822; STR-IR78.01) Avail: NTIS HC A06/MF A01 CSCL 08/5

This set of twelve FORTRAN subroutines will convert the coordinates of a point given in geographic, military, state planar, or Universal Transverse Mercator form to coordinates represented in a second form chosen from the four coordinate types. GRA

N80-28851# Defense Mapping Agency Aerospace Center, St. Louis, Mo. Advanced Technology Div.
DIGITAL IMAGE TECHNOLOGY 1980: EMERGING PRODUCTION APPLICATIONS Final Report
Marshall B. Faintich 5 Mar. 1980 19 p ref Submitted for publication Original contains color illustrations
(AD-A085163) Avail: NTIS HC A02/MF A01 CSCL 08/2

The Defense Mapping Agency Aerospace Center has developed a program to exploit digital image technology for the advancement of mapping, charting, and geodesy. Primary investigations include image processing, analysis, and display techniques, and computer image generation. A dramatic impact has been made in the ability to produce, analyze, and validate various digital data bases produced by the Defense Mapping Agency by applying state-of-the-art digital image technology concepts to the development of new interactive prototype and production systems. GRA

N80-28852# Geological Survey, Reston, Va.
US GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT, SAN JOAQUIN EXPERIMENTAL RANGE
Janet Bonner, comp. and Marrianne Moskowitz, comp. 1980 56 p
(PB80-169295) Avail: NTIS HC A04/MF A01 CSCL 08F

Photographs and images of the San Joaquin experimental range and adjacent areas available from the U.S. Geological Survey (USGS) are listed. LANDSAT, Skylab, NASA aircraft, and USGS photographs are included in the listing. Computer listings of data are provided by the EROS Data Center which contains in its archives all of the listed material in photographic form and, in the case of LANDSAT images, can make available computer-compatible magnetic tapes of any LANDSAT scene. GRA

N80-28853# Virginia Dept. of Highways and Transportation, Richmond. Aerial Safety Section.
AEROTRIANGULATION CONTROL OF LARGE SCALE PHOTOGRAPHY FROM SMALL SCALE PHOTOGRAPHY Final Report
George W. Habel, Jr. 26 Oct. 1979 49 p Sponsored by Federal Highway Administration
(PB80-161524; FHWA-VA-79-1) Avail: NTIS HC A03/MF A01 CSCL 14E

Tests were conducted to determine if a simultaneous adjustment of high and low altitude photography would yield results superior to either scale when used alone. These tests also offered an excellent opportunity to test the metric qualities of two different cameras and the relative metric qualities of black and white and color film. It was concluded that using a simultaneous adjustment is a good photogrammetric practice under certain circumstances. It was also found that the RC-10 camera normally gave a flatter bridge than the RC-8, and there was no appreciable difference in the metric qualities of the black and white and color film used in these tests. GRA

N80-28854# Idaho Univ., Moscow. Water Resources Research Inst.
ION EXCHANGE RECOVERY OF COBALT AND COPPER *FROM BLACKBIRD MINE DRAINAGE*
K. A. Prisbrey, J. F. Williams, and H. Lee Jan. 1980 30 p refs Presented at the Ann. AIME Meeting, Las Vegas, Nev.,

24-28 Feb. 1980
(PB80-166457; WB0-04296; OWRT-A-057-IDA(1)) Avail: NTIS HC A03/MF A01 CSCL 07D

Approximately 300 ppm copper and 50 ppm cobalt flow in a 400 gallon per minute acid mine drainage stream named Bucktail Creek from the Blackbird Mine near Cobalt, Idaho in the Salmon National Forest. Bucktail Creek is part of the Panther Creek drainage. Salmon, Steelhead and other aquatic life are destroyed up to twenty miles downstream from the heavy metal contamination. Ion exchange resin beads contaminants to less than 0.1 ppm cobalt and copper. Equilibrium and kinetic data are extracted from laboratory tests for cobalt and copper loading. Field tests using fluidized ion exchange demonstrate the feasibility of this strategy to reduce contaminants. The advantages of the fluidized systems are discussed and compared to other alternatives. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 85 Urban Technology and Transportation.

N80-28855 Ohio State Univ., Columbus.
A NEW PROBABILISTIC SIMULATION TECHNIQUE FOR MULTIPLE ENERGY STORAGE DEVICES FOR ELECTRIC UTILITY GENERATION SYSTEM EXPANSION PLANNING MODELS Ph.D. Thesis
Brian Manhire 1980 338 p
Avail: Univ. Microfilms Order No. 8015903

A computationally feasible probabilistic production cost model is described which is capable of evaluating the impact on the operating cost of an electric utility of multiple energy storage technologies such as pumped storage hydroelectric, storage batteries, cryogenic storage, flywheels, and gas turbines utilizing compressed air storage. The model is capable of simulating the complex interactions of individual units of each storage technology with the remaining units, both storage and nonstorage, of the power system. Operating characteristics of the various energy storage technologies including forced outage rates, cycle efficiencies, fuel characteristics, and storage capability constraints are considered in the model as well as differences between these characteristics among individual units within each storage technology. The model is oriented toward the Wien Automatic System Planning Package, a widely used generation system expansion planning model. It is also able to simulate individually, multiple generating units whose energy use is preassigned.
Dissert. Abstr.

N80-28856# Varigas Research, Inc., Timonium, Md.
COMPARATIVE STUDY OF THE ENERGY CHARACTERISTICS OF POWERED HAND TOOLS. PART 2: INVESTIGATION REPORTS Final Report
[1980] 254 p
(Contract EY-77-C-03-1731)
(SAN/1731-T2) Avail: NTIS HC A12/MF A01

The results of a theoretical analysis and a field test program to determine the relative energy efficiencies of different types of powered hand tools are presented. Grinders, drills, and nutrunners powered by hydraulic fluid, compressed air, 60 Hz single phase electricity, three phase 180 Hz electricity, three phase 360 Hz electricity, and in the case of flexible shaft tools, three phase 60 Hz power were analyzed and tested. The work included the determination of the energy use of the total system including air compressors and frequency converters where appropriate. Distribution system losses were also considered. Pneumatic tools, the most popular tools in industry, were found to use between five and fifteen times more energy than the various electrically powered tools, to do the same work.
E.D.K.

N80-28857# Gulf Research and Development Co., Pittsburgh, Pa.
REFINERY ENERGY PROFILE Final Report
R. W. Maier, W. P. Olivent, D. L. Brandt, and T. G. Golden
Jan. 1979 301 p
(Contracts DE-AC05-77CS-05262; EY-77-C-05-5262)
(ORO-5262-5-Suppl) Avail: NTIS HC A14/MF A01

A technique for preparing energy profiles at any refinery was developed. Analysis of Gulf's Alliance refinery profiles showed that about 75% of the energy leaving the refinery was lost from two areas: heater stacks (25%) and air and waster cooled heat exchangers (50%). Further analysis led to estimates of the amount of energy potentially recoverable from these two areas. Total refinery energy consumption would be cut up to 6% if all heaters could be economically modified using existing technology to operate at arbitrarily selected control points of 10% excess air and 350 F stack temperature. Comsumption would be cut up to another 19% if technology could be developed to economically recover all heat currently being rejected above 200 F in air and water cooled heat exchangers. If this same picture holds true for all U.S. refineries, a potential would exist for saving up to 350,000 barrels of crude per day in the U.S. However, due to the technical and economic considerations that must be applied to each heater and exchanger, the actual savings would be limited to some fraction of this potential.
E.D.K.

N80-28858# Washington State Univ., Pullman.
COMPARISON OF COAL-FIRED POWER SYSTEMS IN WASTE HEAT APPLICATIONS IN TACOMA, WASHINGTON M.S. Thesis
Jeremy Robertson 1979 237 p refs
(Contract EE-77-S-05-5516)
(TID-29379) Avail: NTIS HC A11/MF A01

The use of the waste stream of heat produced as a by-product of electrical power generation in a coal fired power plant is analyzed. Efficiency gains in the utilization of waste heat, and environmental impact and economic costs are compared for two types of plants supplying waste heat and for a conventional energy supply system that does not make use of waste heat. Small scale modular integrated utility systems plants are compared with a large power plant. The basis of comparision of systems is investment in an equivalent 300 MW of installed capacity. Power plant technologies are described for all systems as are alternative modes of operation. Waste heat utilization is concluded to be advantageous in efficiency of energy conversion as well as in impacts borne, and is economically competitive in most circumstances. Garden apartments as an end use are clearly superior in all categories to single dwellings.
E.D.K.

N80-28859*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. Energy Technology Operation.
COGENERATION TECHNOLOGY ALTERNATIVES STUDY (CTAS). VOLUME 2: ANALYTICAL APPROACH Final Report
H. E. Gerlaugh, E. W. Hall, D. H. Brown, R. R. Priestley, and W. F. Knightly May 1980 106 p refs
(Contract DEN3-31)
(NASA-CR-159766; DOE/NASA/0031-80-2; GEBOET010-Vol-2) Avail: NTIS HC A06/MF A01 CSCL 10B

The use of various advanced energy conversion systems were compared with each other and with current technology systems for their savings in fuel energy, costs, and emissions in individual plants and on a national level. The ground rules established by NASA and assumptions made by the General Electric Company in performing this cogeneration technology alternatives study are presented. The analytical methodology employed is described in detail and is illustrated with numerical examples together with a description of the computer program used in calculating over 7000 energy conversion system-industrial process applications. For Vol. 1, see N80-24797.
R.E.S.

N80-28860*# Spectrolab, Inc., Sylmar, Calif.
COPLANAR BACK CONTACTS FOR THIN SILICON SOLAR CELLS Final Report, Jul. 1978 - Dec. 1979
Jay W. Thornhill and W. E. Sipperly Mar. 1980 36 p refs
(Contract NAS3-21251)

(NASA-CR-159811) Avail: NTIS HC A03/MF A01 CSCL 10A

A process for fabricating 2 to 3 mil wraparound solar cells was formulated. Sample thin wraparound cells were fabricated using this process. The process used a reinforced perimeter construction to reduce the breakage that occurs during handling of the wafers. A retracting piston post was designed and fabricated to help minimize the breakage that occurs during the screen printing process. Two alternative methods of applying the aluminum back surface field were investigated. In addition to the standard screen printed back surface field, both spin-on and evaporated aluminum techniques were researched. Neither spin-on nor evaporated aluminum made any noticeable improvement over the screen printing technique. A fine screen mesh was chosen for the application of the aluminum paste back surface field. The optimum time and temperature for firing the aluminum turned out to be thirty seconds at 850 C. The development work on the dielectric included looking at three dielectrics for the wraparound application. Transene 1000, Thick Film Systems 1126RCB and an in house formulation 61-2-2A were all tested. Cells with pre-dielectric thickness of 3.0-0-3.5 mils using Transene 1000 as the wraparound dielectric and the procedure outlined above showed an average efficiency of 10.7 percent. Thinner cells were fabricated, but had an unacceptable yield and efficiency. R.E.S.

N80-28861*# Honeywell, Inc., Minneapolis, Minn. Energy Resources Center.

INSTALLATION GUIDELINES FOR SOLAR HEATING SYSTEM, SINGLE-FAMILY RESIDENCE AT WILLIAM OBRIEN STATE PARK, STILLWATER, MINNESOTA

May 1980 187 p Sponsored in part by DOE

(Contract NAS8-32093)

(NASA-CR-161480) Avail: NTIS HC A09/MF A01 CSCL 10B

Installation procedures for the single family residential solar heating system at the William O'Brien State Park, Stillwater, Minnesota, are presented. The system is a solar-assisted, hydronic-to-warm-air system with solar-assisted domestic water heating. It is composed of the following major components: liquid cooled flat plate collectors; water storage tank; passive solar-fired domestic water preheater; electric hot water heater; heat pump with electric backup; solar hot water coil unit; tube-and-shell heat exchanger, three pumps, and associated pipes and valving in an energy transport module; control system; and air-cooled heat purge unit. Installer guidelines are provided for each subsystem and includes testing and filling the system. Information is also given on the operating procedures, controls, caution requirements and routine and schedule maintenance. R.E.S.

N80-28862*# General Dynamics/Convair, San Diego, Calif.

STUDY OF POWER MANAGEMENT TECHNOLOGY FOR ORBITAL MULTI-100KWe APPLICATIONS. VOLUME 2: STUDY RESULTS Final Report

J. W. Mildice 15 Jul. 1980 293 p 3 Vol.

(Contract NAS3-21757)

(NASA-CR-159834-Vol-2; GDC-ASP-80-015) Avail: NTIS HC A13/MF A01 CSCL 10B

The preliminary requirements and technology advances required for cost effective space power management systems for multi-100 kilowatt requirements were identified. System requirements were defined by establishing a baseline space platform in the 250 KE KWe range and examining typical user loads and interfaces. The most critical design parameters identified for detailed analysis include: increased distribution voltages and space plasma losses, the choice between ac and dc distribution systems, shuttle servicing effects on reliability, life cycle costs, and frequency impacts to power management system and payload systems for AC transmission. The first choice for a power management system for this kind of application and size range is a hybrid ac/dc combination with the following major features: modular design and construction-sized minimum weight/life cycle cost; high voltage transmission (100 Vac RMS); medium voltage array < or = 440 Vdc); resonant inversion; transformer rotary joint; high frequency power transmission line > or = 20 KHz); energy storage on array side or rotary joint; fully redundant; and 10 year life with minimal replacement and repair. J.M.S.

N80-28863*# Hughes Aircraft Co., El Segundo, Calif. Technology Div.

CONCEPTUAL DESIGN STUDY OF CONCENTRATOR ENHANCED SOLAR ARRAYS FOR SPACE APPLICATIONS. 2kW Si AND GaAs SYSTEMS AT 1 AU Final Report

20 Mar. 1980 55 p

(Contracts NAS7-100; JPL-955194)

(NASA-CR-163046; HAC-E3256; JPL-9950-377) Avail: NTIS HC A04/MF A01 CSCL 10A

The effect of concentration level on the specific power for a deployable, thin, gallium arsenide cell array in geosynchronous orbit for 10 years in conjunction with a two dimensional flat plate trough concentrator (V trough) and also with a multiple flat plate concentrator was investigated as well as the effects for a conventional silicon cell array on a rigid substrate. For application to a thin GaAs array at 1 AU for 10 years, the V trough produces a 19% benefit in specific power and a dramatic reduction in array area, while the multiple flat plate collector design is not only of no benefit, but is a considerable detriment. The benefit it achieves by reducing array area is duplicated by the 2D design. For the silicon array on a rigid substrate, improvement in performance due to a concentrator with ordinary mirror coating is quite small: 9% increase in specific power, and 13% reduction in array area. When the concentrator mirrors are coated with an improved cold mirror coating, somewhat more significant results are obtained: 31% specific power improvement; and 27% area reduction. In both cases, a 10 year exposure reduces BOL output by 23%. A.R.H.

N80-28864*# Westinghouse Research and Development Center, Pittsburgh, Pa.

SILICON WEB PROCESS DEVELOPMENT Annual Report, Apr. 1979 - 1980

C. S. Duncan, R. G. Seidensticker, J. P. McHugh, F. E. Hill, M. E. Skutch, J. M. Driggers, and R. H. Hopkins 30 Jun. 1980 171 p refs

(Contract JPL-954654)

(NASA-CR-163386; DOE/JPL-954654-80/11; JPL-9950-378) Avail: NTIS HC A08/MF A01 CSCL 10A

A barrier crucible design which consistently maintains melt stability over long periods of time was successfully tested and used in long growth runs. The pellet feeder for melt replenishment was operated continuously for growth runs of up to 17 hours. The liquid level sensor comprising a laser/sensor system was operated, performed well, and meets the requirements for maintaining liquid level height during growth and melt replenishment. An automated feedback loop connecting the feed mechanism and the liquid level sensing system was designed and constructed and operated successfully for 3.5 hours demonstrating the feasibility of semi-automated dendritic web growth. The sensitivity of the cost of sheet, to variations in capital equipment cost and recycling dendrites was calculated and it was shown that these factors have relatively little impact on sheet cost. Dendrites from web which had gone all the way through the solar cell fabrication process, when melted and grown into web, produce crystals which show no degradation in cell efficiency. Material quality remains high and cells made from web grown at the start, during, and the end of a run from a replenished melt show comparable efficiencies. E.D.K.

N80-28865*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

SOLAR/HYDROGEN SYSTEMS ASSESSMENT. VOLUME 1: SOLAR/HYDROGEN SYSTEMS FOR THE 1985 - 2000 TIME FRAME Final Report

R. W. Foster (Escher: Foster Tech. Associates, Inc.), R. R. Tison (Escher: Foster Tech. Associates, Inc.), W. J. D. Escher (Escher: Foster Tech. Associates, Inc.), and J. A. Hanson 2 Jun. 1980 149 p refs 2 Vol.

(Contracts NAS7-100; JPL-955492)

(NASA-CR-163392; JPL-9950-379) Avail: NTIS HC A07/MF A01 CSCL 10B

Opportunities for commercialization of systems capable of producing hydrogen from solar energy were studied. The hydrogen product costs that might be achieved by the four selected candidate systems was compared with the pricing structure and practices of the commodity gas market. Subsequently, product cost and market price match was noted to exist in the small

user sector of the hydrogen marketplace. Barriers to and historical time lags in, commercialization of new technologies are reviewed. Recommendations for development and demonstration programs designed to accelerate the commercialization of the candidate systems are presented. R.E.S.

N80-28866*# Midwest Research Inst., Kansas City, Mo.
THERMAL ENERGY STORAGE SYSTEMS USING FLUIDIZED BED HEAT EXCHANGERS Final Report, Jan. 1979 - Jan. 1980
Tom Weast and Larry Shannon Jun. 1980 209 p
(Contracts DEN3-96; EC-77-A-31-1034)
(NASA-CR-159868; DOE/NASA/0096-1) Avail: NTIS
HC A10/MF A01 CSCL 10C

A rotary cement kiln and an electric arc furnace were chosen for evaluation to determine the applicability of a fluid bed heat exchanger (FBHX) for thermal energy storage (TES). Multistage shallow bed FBHX's operating with high temperature differences were identified as the most suitable for TES applications. Analysis of the two selected conceptual systems included establishing a plant process flow configuration, an operational scenario, a preliminary FBHX/TES design, and parametric analysis. A computer model was developed to determine the effects of the number of stages, gas temperatures, gas flows, bed materials, charge and discharge time, and parasitic power required for operation. The maximum national energy conservation potential of the cement plant application with TES is 15.4 million barrels of oil or 3.9 million tons of coal per year. For the electric arc furnance application the maximum national conservation potential with TES is 4.5 million barrels of oil or 1.1 million tons of coal per year. Present time of day utility rates are near the breakeven point required for the TES system. Escalation of on-peak energy due to critical fuel shortages could make the FBHX/TES applications economically attractive in the future. E.D.K.

N80-28867# Naval Research Lab., Washington, D. C. Marine Technology Div.
OTEC COLD WATER PIPE DESIGN FOR PROBLEMS CAUSED BY VORTEX-EXCITED OSCILLATIONS Final Report
Owen M. Griffin 14 Mar. 1980 148 p refs Sponsored in part by NOAA
(AD-A084555; AD-E000413; NRL-MR-4157) Avail: NTIS
HC A07/MF A01 CSCL 13/11

Vortex-excited oscillations of marine structures result in reduced fatigue life, large hydrodynamic forces and induced stresses, and sometimes lead to structural damage and to destructive failures. The cold water pipe of an OTEC plant is nominally a bluff, flexible cylinder with a large aspect ratio (L/D length/diameter), and is likely to be susceptible to resonant vortex-excited oscillations. The objective of this report is to survey recent results pertaining to the vortex-excited oscillations of structures in general and to consider the application of these findings to the design of the OTEC cold water pipe. Practical design calculations are given as examples throughout the various sections of the report. This report is limited in scope to the problems of vortex shedding from bluff, flexible structures in steady currents and the resulting vortex-excited oscillations. The effects of flow non-uniformities, surface roughness of the cylinder, and inclination to the incident flow are considered in addition to the case of a smooth cylinder in a uniform stream. Emphasis is placed upon design procedures, hydrodynamic coefficients applicable in practice, and the specification of structural response parameters relevant to the OTEC cold water pipe. There are important problems associated with the shedding of vortices from cylinders in waves and from the combined action of waves and currents, but these complex fluid/structure interactions are not considered in this report. GRA

N80-28868# Westinghouse Electric Corp., Pittsburgh, Pa.
RIBBON GROWTH OF SINGLE CRYSTAL GaAs FOR SOLAR CELL APPLICATION Interim Technical Report, 15 Aug. 1978 - 15 Aug. 1979
Theresa A. Gould, Raymond G. Seidensticker, and Robert Mazelsky Wright-Patterson AFB, Ohio AFAPL 30 Nov. 1979 65 p refs
(Contract F33615-78-C-2031; AF Proj. 3145)
(AD-A084831; AFAPL-TR-79-2094) Avail: NTIS
HC A04/MF A01 CSCL 10/2

This report describes the first 12 months of a program to develop GaAs dendritic web. Liquid encapsulation with B203 is used to suppress As vaporization from the melt. Standard web growth system design and experimental techniques which have been developed at Westinghouse for Si web are also utilized for the GaAs program. Critical optimization of thermal geometry is achieved with computerized thermal modeling. Dendritic growth and web buttoning of GaAs have been observed in the current program. Web crystals have not yet been produced, however, a piece of primitive web material has been recovered from the system. The growth behavior and the morphology of GaAs dendrites, buttons, and web material are analogous to the results obtained from successful Si and Ge web growth systems. The thermal modeling results also indicate that the liquid encapsulated GaAs system is suitable for web growth. GRA

N80-28869# Naval Surface Weapons Center, White Oak, Md.
THERMOELECTRIC MATERIALS FOR SOLAR ENERGY CONVERSION Final Report, Aug. - Dec. 1978
J. F. Goff and J. R. Lowney 1 Feb. 1979 22 p refs Presented at 14th Intersol. Energy Conversion Eng. Conf., Boston, 5 Aug. 1979
(AD-A084948; NSWC/TR-79-247) Avail: NTIS
HC A02/MF A01 CSCL 10/2

The thermoelectric efficiency index of N-type beta-SiC has been calculated by use of the Goff-Lowney integral formulation. The scattering parameters were estimated by fitting the thermoelectric power and electrical conductivity data of Golikova, et al. The parasitic photon thermal conductivity was calculated theoretically by use of the theory of Devyatkova, et al, while the lattice thermal conductivity was treated parametrically. The results indicate that there exists an optimum carrier concentration of approximately 2 x ten to the 20th power/ccm and that the efficiency is still increasing at 2000K. GRA

N80-28870# Pittsburgh Univ., Pa. Dept. of Chemistry.
STUDY OF MATERIALS HAVING SIGNIFICANCE FOR HIGH ENERGY MAGNET PRODUCTION AND HYDROGEN STORAGE Final Report, 1 Mar. 1977 - 29 Feb. 1980
W. E. Wallace 15 May 1980 23 p refs
(Grant DAAG29-77-G-0110)
(AD-A084943; ARO-14517.31-MS) Avail: NTIS
HC A02/MF A01 CSCL 09/1

A summary is given of work dealing with the development of new permanent magnet materials and new materials for hydrogen storage. The work is reported in detail in 39 publications which have appeared or will appear in the open literature. These include 10 reviews of the subject matter of the program. Among the most significant findings are the following: (1) hydrogen in rare earth and actinide intermetallics behaves as if it were anionic; (2) hydrogenation can either 'switch off' or 'switch on' ferromagnetism, depending on the system; (3) the superconductor Th7Fe3 is converted into a ferromagnet when hydrogenated; (4) the mechanism of hydrogen uptake has been thoroughly elucidated; (5) Er2Co17 and Yb2Co17-based systems have been identified as potentially useful permanent magnet materials; (5) Cr substitution for Co in Sm2Co17 has a powerful beneficial effect on anisotropy. GRA

N80-28871# Eureka Advance Science Corp., Bloomington, Ill. Advance Science Div.
ADVANCED THERMAL BATTERIES Interim Report, 15 Sep. 1978 - 15 Sep. 1979
David M. Ryan Mar. 1980 165 p
(Contract F33615-77-C-3147; AF Proj. 3145)
(AD-A085193; AFWAL-TR-80-2017) Avail: NTIS
HC A08/MF A01 CSCL 10/3

The feasibility of building thermal batteries with cells composed of an anode of LiAl alloy, a cathode of a heavy metal chloride, and a NaAlCl4 electrolyte has been demonstrated. During the further investigation of this system some interesting problems have developed and had to be studied. The particle size growth of the catholyte developed into a major storage problem. MoCl5 was found to form a volatile catholyte which is not suited for thermal battery use. As a result of this problem other catholyte materials were experimented with. CuCl2 is the most successful alternate to MoCl5. Some alternate binder

materials have been investigated: kaolin clay, Illinois Mineral Amorphous Silica, and magnesia. Some alternate electrolytes have been investigated including NaAlCl4 (containing 52 m/o AlCl3), LiAlCl4 and KCl-LiCl. This work indicates that each material has unique properties which lend themselves to a particular application. Among the alternate cathode materials experimented with are CrCl3, a number of heavy metal oxides, fluorocarbon, TiS2, TiS3, and sulfur. Some alternate process investigated have been freon blending, adding materials to the anode, cell and battery desiccation and filling batteries with an inert atmosphere. GRA

N80-28872# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.

A STUDY OF AIRCRAFT NiCd BATTERY STATE-OF-CHARGE MEASUREMENT BY PHASE METER Interim Report

Michael R. Martinelli, Stanley W. Mayer, and Charles C. Badcock 30 Apr. 1980 35 p refs

(Contract F04701-79-C-0080)

(AD-A084935; TR-0080(5970-01)-2; SD-TR-80-24) Avail: NTIS HC A03/MF A01 CSCL 10/3

Experiments were performed to determine if the phase angle between alternating voltage and current could be used to predict, within a probable error of 5 percent, the state of charge of vented NiCd aircraft batteries. A 22 A hr, 19 cell Gulton type MS24497-4 battery and several individual cells from that battery were tested in these experiments. The battery was charged for various lengths of time at 11 amperes to obtain a range of state of charge. Battery phase angle and individual cell phase angles were measured with a Hewlett-Packard HP-3575A gain-phase meter at frequencies of 350, 100, 35, 17.5, and 11 Hz; and the cells were discharged at 11 amperes to 0.1 V (1.9 V for the battery) to determine their state of charge in ampere-hours of capacity. The phase-angle, state-of-charge data were subjected to second-order polynomial curve fitting by means of least-squares analysis. The probable errors obtained from the least-squares analyses were used to judge the quality of measured correlation between phase angle and state of charge. The results for the individual cells were, on the whole, quite poor, although two of the individual cells tested achieved the stated goal of a probable error of 5 percent for the correlation between phase angle and state of charge. The 19 cell battery gave the best results with a probable error of 3.8 percent measured at 11 Hz. GRA

N80-28873# Aerospace Corp., El Segundo, Calif. Chemistry and Physics Lab.

PHASE METER MEASUREMENT OF STATE OF CHARGE FOR SATELLITE NiCd CELLS, A PRELIMINARY STUDY Interim Report

Michael R. Martinelli, Stanley W. Mayer, and Charles C. Badcock 30 Aug. 1979 31 p refs

(Contract F04701-78-C-0079)

(AD-A084907; TR-0079(4970-10)-3; SAMSO-TR-79-93) Avail: NTIS HC A03/MF A01 CSCL 10/3

Experiments were performed to determine if the phase angle between alternating voltage and current could be used to predict, within a probable error of 5%, the state of charge of seven individual sealed (General Electric model 10AB08 NiCd) cells and a battery consisting of the seven cells in series. The cells were charged for various lengths of time at 0.8 A to obtain a range of state of charge; their phase angles were measured with a Hewlett-Packard HP3575A gain-phase meter at 35 Hz; and they were discharged at 5 A 0.1 V to determine their state of charge in ampere-hours of capacity. The phase angle state-of-charge data were subjected to second-order polynomial curve fitting by means of least-squares analysis. The probable errors obtained from the least-squares analysis were used to judge the quality of the measured correlation between phase angle and state of charge. In order to determine how the correlation might be affected through cell use, the four extensively cycled cells with more than 3700 charge-discharge cycles and three cells with less than 40 such cycles were tested. The effect of temperature on the correlation was also studied. GRA

N80-28874# Sandia Labs., Albuquerque, N. Mex. Geothermal Research Div.

MAGMA ENERGY: A FEASIBLE ALTERNATIVE

John L. Colp Mar. 1980 22 p refs

(Contract EY-76-C-04-0789)

(SAND-80-0309) Avail: NTIS HC A02/MF A01

A short review of the work performed in connection with the Magma Energy Research Project is provided. Results to date suggest that boreholes will remain stable down to magma depths and engineering materials can survive the downhole environments. Energy extraction rates are encouraging. Geophysical sensing systems and interpretation methods require improvement, however, to clearly define a buried magma source. DOE

N80-28875# Oak Ridge National Lab., Tenn.

PLASMA-SPRAYED COATINGS FOR VERY HIGH TEMPERATURE SOLAR ABSORBERS

James M. Schreyer, Richard A. Hays (White Sands Missile Range), Charles R. Schmitt (Oak Ridge Y-12 Plant), and Darrell Farwell (White Sands Missile Range) 1979 10 p Presented at the 2d Am. Electroplaters Soc. Symp. on Coating for Solar Collectors, St. Louis, 16 Oct. 1979

(Contract W-7405-eng-26)

(CONF-791021-3) Avail: NTIS HC A02/MF A01

Plasma-sprayed coatings on steel plates were tested at temperatures from 200 C to 1000 C. Analysis of the specimens before and after testing showed erbium dodecaboride, yttrium hexaboride, titanium diboride, and chromium oxide to be stable above 600 C. A heat balance on the water cooled specimens of these coatings showed 71% to 97% heat recovery efficiency. DOE

N80-28876# Sandia Labs., Albuquerque, N. Mex.

ANALYSIS OF THE INFLUENCE OF GEOGRAPHY AND WEATHER ON PARABOLIC TROUGH SOLAR COLLECTOR DESIGN

George W. Treadwell, Norman R. Grandjean, and Frank Biggs Mar. 1980 28 p refs

(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)

(SAND-79-2032) Avail: NTIS HC A03/MF A01

The potential performance of single-axis tracking parabolic trough solar collectors as a function of optical energy distribution and receiver size was calculated for eleven sites using typical meteorological year input data. A simulation based on the SOLTES code was developed which includes the three dimensional features of a parabolic trough and calculates the thermo-optical tradeoffs. The capability of the thermo-optical model was confirmed by the comparison of calculated results with the experimental results from an all day test of a parabolic trough. The results from this eleven site analysis indicate a potential performance superiority of a north-south horizontal axis trough and, in addition, a high quality collector should be of the same geometric design for all of the sites investigated and probably for all regions of the country. DOE

N80-28877# California Univ., Livermore. Lawrence Livermore Lab.

EFFECT OF A HEATED ATMOSPHERE ON THE EMITTANCE OF BLACK CHROME SOLAR COLLECTOR PIPE SURFACES

Thomas A. Reitter and Warren H. Giedt (California Univ., Davis) 21 Mar. 1980 6 p refs Presented at Am. Section of Intern. Solar Energy Soc. Conf., Phoenix, Ariz., 2-6 Jun. 1980

(Contract W-7405-eng-48)

(UCRL-83506; CONF-800604-6) Avail: NTIS HC A02/MF A01

The total hemispherical emittance of the surfaces of solar collectors pipes was measured in the temperature range 100 to 300 C before and after exposure to heated humid or dry air atmosphere. The first exposure to heated air lowered the emittance of black chrome surface about 20%. Similar exposure increased the emittance of bare steel significantly, but had no effect on a nickel surface. Subsequent exposures to heated dry or humid air lowered the emittance of the black chrome surfaces by lesser amounts in what appeared to be a limiting process. In all cases, the emittance of the black chrome surfaces increased strongly with temperature. A possible explanation for the lowering of the black chrome emittance is the oxidation and subsequent outgassing of carbon contaminants in the black chrome coating. DOE

N80-28878# Sandia Labs., Albuquerque, N. Mex. Electromechanical Subsystems Dept.
MULTIPLE-TANK HIGH TEMPERATURE STORAGE SUBSYSTEM Summary Report
Robert A. Randall Feb. 1980 34 p
(Contract EY-76-C-04-0789)
(SAND-79-2056) Avail: NTIS HC A03/MF A01

The design, construction, installation, and testing of a multiple-tank thermal energy storage subsystem at the Midtemperature Solar Systems Test Facility located in Sandia Laboratories, Albuquerque, New Mexico are described. Included are the design requirements and a description of the subsystem. Also discussed are the test procedures and test results to evaluate thermal performance. System costs are listed. Subsequent tests are planned to evaluate control techniques and logic. DOE

N80-28879# Electric Power Research Inst., Palo Alto, Calif.
ELECTRIC UTILITY SOLAR ENERGY ACTIVITIES: 1979 SURVEY Special Report, Dec. 1979
Robin Furness Dec. 1979 217 p
(EPRI-ER-1299-SR) Avail: NTIS HC A10/MF A01

The results of surveys to determine the scope of solar energy projects sponsored by electric utilities in the United States are presented. It contains brief descriptions of 735 projects being conducted by 180 utility companies. Also included are an index of projects by category, a statistical summary, a list of participating utilities with information contacts and addresses, a list of utilities with projects designated by category, a list of utilities organized by state, and a list of available reports on utility-sponsored projects. DOE

N80-28880# Alabama Univ. in Huntsville. Johnson Environment and Energy Center.
SOLAR ENERGY FOR BUILDINGS HANDBOOK
David L. Christensen Oct. 1979 268 p
(Contracts EG-77-S-05-5362; DE-AC05-77ET-20170)
(ORO-5362-T1) Avail: NTIS HC A12/MF A01

This handbook contains presentation materials and supporting text suitable for presentations, education, short courses, etc., for general audiences, as well as government officials and members of the building trade. The following are discussed: conservation, solar energy, economics, obstructions, and the future. DOE

N80-28881# Hughes Research Labs., Malibu, Calif.
PHOTOVOLTAIC MECHANISMS IN POLYCRYSTALLINE THIN-FILM SOLAR CELLS Quarterly Technical Progress Report, 27 Apr. - 27 Jul. 1979
Kenneth Zanio Oct. 1979 30 p refs
(Contract ET-78-C-01-3412)
(DSE-3412-T3; QTPR-3) Avail: NTIS HC A03/MF A01

Indium phosphide films were prepared on (100) InP substrates by the planar reactive deposition technique in the temperature range 220 C to 260 C and growth rates of about 1 micron/hr, complete single-crystal epitaxy was achieved. The onset of the single-crystal to polycrystalline transition at 245 C is characterized by a mosaic structure. Parallel studies to eventually passivate the grain boundaries in polycrystalline films were undertaken. A 5HC1:3HNO3:4HF etch was found to preferentially attack 90% of the grain boundaries in bulk polycrystalline InP wafers. Canyons with depths greater than 10 micron and widths less than 1 micron were the most common form of attack. Although the etch had no effect on simple twin boundaries, preferential attack was observed at interfaces formed by multiple twinning events. DOE

N80-28882# Department of Energy, Washington, D. C. Office of Technology Impacts.
ENVIRONMENTAL DATA ENERGY TECHNOLOGY CHARACTERIZATIONS: COAL
Apr. 1980 172 p refs Supersedes DOE/EV-0061/3
(DOE/EV-0074; DOE/EV-0061/3) Avail: NTIS HC A08/MF A01

The activities leading to the conversion of coal to electricity consist of coal mining and beneficiation, coal transport, electric power generation, and power transmission. To enhance the usefulness of the material presented, resource requirements, energy products, and residuals for each activity area are normalized in terms of 10 to the 12th power Btus of energy produced. Thus, the total effect of producing electricity from coal can be determined by combining the residuals associated with the appropriate activity areas. Emissions from the coal cycle are highly dependent upon the type of coal consumed as well as the control technology assigned to the activity area. Each area is assumed to be equipped with currently available control technologies that meet environmental regulations. DOE

N80-28883# Carnegie-Mellon Univ., Pittsburgh, Pa.
RECENT DEVELOPMENTS IN THE FOAM OTEC SYSTEM
Clarence Zener, Alberto Molini, Tomlinson Fort, Jr, John Fetkovich, and Martin Greenstein 1979 7 p refs Presented at the 6th OTEC Conf., Washington, D.C., 19 Jun. 1979
(Contract EG-77-S-02-4459)
(CONF-790631-15) Avail: NTIS HC A02/MF A01

In the foam open cycle OTEC system warm water literally lifts itself several hundred feet. In preliminary experiments the foam behavior seemed to depend in a capricious manner upon the temperature of the incoming water, the pressure of the spray condenser, and the foam mass flow rate. Through a combination of analysis and experiment, an equation which governs the steady state rise of a foam column was developed. This equation correctly predicts the effects upon the foam behavior of all controllable parameters. These parameters include, in addition to those mentioned above, the diameter and height of the foam column. It is shown that foam generated in an appropriate manner flows laminarly rather than turbulently and has defined drag function. This drag function decreases as the inverse square of the column diameter. DOE

N80-28884# General Electric Co., Schenectady, N. Y. Corporate Research and Development.
REGENERATIVE FLYWHEEL ENERGY STORAGE SYSTEM
Edward L. Lustanader, Ivan H. Edelfelt, Donald W. Jones, Allan B. Plunkett, Eike Richter, and Fred G. Turnbull [1979] 34 p refs
(Contract W-7405-eng-48)
(UCRL-13982-Rev-1) Avail: NTIS HC A03/MF A01

The development, fabrication, and testing of a regenerative flywheel energy storage and recovery system for a battery/flywheel electric vehicle of the 3000 lb class are described. The vehicle propulsion system was simulated on a digital computer in order to determine the optimum system operating strategies and establish a calculated range improvement over a nonregenerative, all-electric vehicle. Fabrication of the inductor motor, flywheel, power conditioner, and system control are described. Test results of the system operating over the SAE J227a Schedule D driving cycle are given and are compared to the calculated value. The flywheel energy storage system consists of a solid rotor, synchronous, inductor-type, flywheel drive machine electrically coupled to a dc battery electric propulsion system through a load commutated inverter. The motor/alternator unit is coupled mechanically to a small steel flywheel which provides a portion of the vehicle's accelerating energy and regenerates the vehicle's braking energy. DOE

N80-28885# Argonne National Lab., Ill. Energy and Environmental Systems Div.
HEAT-PUMP-CENTERED INTEGRATED COMMUNITY ENERGY SYSTEMS: SYSTEM DEVELOPMENT SUMMARY
J. M. Calm Feb. 1980 127 p refs
(Contract W-31-109-eng-38)
(ANL/CNSV-7) Avail: NTIS HC A07/MF A01

An introduction to district heating systems employing heat pumps to enable use of low temperature energy sources is presented. These systems operate as thermal utilities to provide space heating and may also supply space cooling, service water heating, and other thermal services. Otherwise wasted heat from industrial and commercial processes, natural sources including solar and geothermal heat, and heat stored on an annual cycle from summer cooling may be effectively utilized by the systems described. More than one quarter of the energy consumed in the United States is used to heat and cool buildings and to heat service water. Natural gas and oil provide approximately 83% of this energy. The systems described show potential to reduce net energy consumption for these services by 20 to 50% and to allow fuel substitution with less scarce resources not practical in smaller, individual building systems.

Seven studies performed for the system development phase are summarized. DOE

N80-28886# Nuclear Regulatory Commission, Washington, D. C.
STATEMENT OF POSITION OF THE UNITED STATES DEPARTMENT OF ENERGY IN THE MATTER OF PROPOSED RULEMAKING ON THE STORAGE AND DISPOSAL OF NUCLEAR WASTE (WASTE CONFIDENCE RULING)
15 Apr. 1980 749 p refs
(DOE/NE-0007) Avail: NTIS HC A99/MF A01

The degree of assurance that radioactive waste can be safely disposed of is assessed. The determination of when such disposal or off-site storage will be available is discussed, as well as whether wastes can be safely stored on-site past license expiration until off-site disposal/storage is available. DOE

N80-28887# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
MASS TRANSFER DEPOSITS IN LITHIUM-TYPE 316 STAINLESS STEEL THERMAL-CONVECTION LOOPS
P. F. Tortorelli and J. H. DeVan 1980 16 p refs Presented at 2d Intern. Conf of Liquid Metal Technol. for Energy Systems, Richland, Wash., 20 Apr. 1980
(Contract W-7405-eng-26)
(CONF-800401-6) Avail: NTIS HC A02/MF A01

In spatially nonisothermal flowing liquid metal systems, selected constituents of the containment materials characteristically dissolve into the liquid metal in the hotter zones and are deposited in the colder areas. The accumulation of deposits is often a more serious problem than dissolution because of attendant flow restrictions and, in reactor applications, the aggregation of radioactive species in the coolant circuits. Accordingly, the deposition processes in lithium-type 316 stainless steel thermal convection loops is studied. The morphology and composition of deposits varied with loop operating time. Initially, chromium rich dendritic crystals formed in the colder region of a loop, but later the deposits changed in structure and contained significant amounts of nickel and iron. Deposition rates were also measured as a function of time and temperature and were correlated with the above observations. A plug extracted from one loop consisted of an aggregate of chromium rich crystals. DOE

N80-28888# Aluminum Co. of America, New Kensington, Pa. Alcoa Labs.
DESIGN AND FABRICATION OF A LOW COST DARRIEUS VERTICAL AXIS WIND TURBINE SYSTEM, PHASE 1
22 Jun. 1979 345 p refs
(Contract EM-78-C-04-4272)
(ALO-4272-T2) Avail: NTIS HC A15/MF A01

The Sandia 17 m was used as the background machine from which design information was drawn. By concentrating the modifications on an existing design, emphasis was focused on component cost reduction rather than selection of optimal configuration or operating modes. The resulting design is a stretched version of the Sandia 17 m preserving the same rotor diameter and many other good features, but lighter in weight, larger in capacity, and anticipated to be more cost effective. DOE

N80-28889# Ehrenkrantz Group, New York, N. Y.
ACTIVE SOLAR ENERGY SYSTEM DESIGN PRACTICE MANUAL
Stephen D. Weinstein Oct. 1979 222 p Prepared in cooperation with Mueller Associates, Inc., Baltimore, Md.
(Contract EG-77-C-01-2522)
(SOLAR/0802-79/01) Avail: NTIS HC A10/MF A01

This manual is divided into liquid and air systems. The following are covered: collectors, collector arrays, mounting and support, storage, dampers, leakage concerns, safety and protection, and other equipment. DOE

N80-28890# Electric Power Research Inst., Palo Alto, Calif.
MANUAL AND PROGRAMMABLE CALCULATOR METHODS FOR SIZING SOLAR ENERGY SYSTEMS
Robert S. Barlow Dec. 1979 79 p refs
(EPRI-ER-1282-SR) Avail: NTIS HC A05/MF A01

The important characteristics, features, and limitations of manual methods and programmable calculator software for sizing active or passive solar energy systems and predicting their performance are described. The intent is to provide utilities with useful information that will facilitate sound choices of solar calculation methods to be used in responding to the National Energy Act. The major issues relating to manual solar calculation methods are discussed. General information on each method is given in easily used matrices. Critical reviews, as well as sources and costs, are given in a one page summary for each method. An effort is made to identify those methods that will be most useful, and overall conclusions are included. DOE

N80-28891# Los Alamos Scientific Lab., N. Mex.
ENERGY SAVINGS OBTAINABLE THROUGH PASSIVE SOLAR TECHNIQUES
J. Douglas Balcomb 1980 13 p refs Presented at the Intern. Congr. on Bldg. Energy Management, Povoa de Varzim, Portugal, 12-16 May 1980
(Contract W-7405-eng-36)
(LA-UR-80-746; CONF-800524-1) Avail: NTIS HC A02/MF A01

A survey of passive solar heating experience, especially in the US, is provided. Design approaches are reviewed and examples shown. Misconceptions are discussed. Advantages are listed. The Los Alamos program of performance simulation and evaluation is described and a simplified method of performance estimation is outlined. DOE

N80-28892# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
REVIEW OF THE CURRENT STATUS OF THE WIND ENERGY INNOVATIVE SYSTEMS PROJECTS
Irwin E. Vas Mar. 1980 77 p refs
(Contract EG-77-C-01-4042)
(SERI/TP-635-469) Avail: NTIS HC A05/MF A01

Information is presented concerning theoretical and experimental studies on giromill turbines; diffuser augmented turbines; tornado turbines; electrofluid dynamic generators; Madaras rotors; the vortex augmented turbines; and cooling tower thermodynamic cycles. DOE

N80-28893# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
LONG-TERM AVERAGE PERFORMANCE BENEFITS OF PARABOLIC TROUGH IMPROVEMENTS
Randy Gee, Harry W. Gaul, David Kearney, and Ari Rabl Mar. 1980 40 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-632-439) Avail: NTIS HC A03/MF A01

Various technology advancements in improving the long term average performance of parabolic trough concentrating collectors were analyzed. The performance benefits of improvements are determined as a function of operating temperature for north-south, east-west, and polar mounted parabolic troughs. The results are presented graphically to allow a quick determination of the performance merits of particular improvements. Substantial annual energy gains are shown to be attainable. Of the improvements evaluated, the development of stable back-silvered glass reflective surfaces offers the largest performance gain for operating temperatures below 150 C. Above 150 C, the development of trough receivers that can maintain a vacuum is the most significant potential improvement. The reduction of concentrator slope errors also has a substantial performance benefit at high operating temperatures. DOE

N80-28894# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
ANALYSIS OF SOLAR COLLECTOR ARRAY SYSTEMS USING THERMOGRAPHY
Anthony Eden Jan. 1980 50 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-351-494) Avail: NTIS HC A03/MF A01

The use of thermography to analyze large solar collector array systems under dynamic operating conditions is discussed. Thermographic techniques as well as equipment to determine temperature distributions, flow patterns, and air blockages in solar collectors are emphasized. The results illustrate the

capabilities of infrared analysis as an analysis tool and operation and maintenance procedure when applied to large arrays. Thermographic analysis of most collector systems showed temperature distributions that indicated balanced flow patterns with both the thermographs and the hand held unit. In three significant cases, blocked or broken collector arrays, which previously had gone undetected, were discovered. DOE

N80-28895# Boeing Aerospace Co., Seattle, Wash.
EMERGING MATERIALS SYSTEMS FOR SOLAR CELL APPLICATIONS: Cu/SUB 2-X/Se
R. A. Mickelsen, J. M. Stewart, and W. S. Chen Feb. 1980 17 p refs
(Contract DE-AC04-79ET-23005)
(DOE/ET-23005-T3; QTPR-3) Avail: NTIS HC A02/MF A01

The feasibility of using Cu/sub 2-x/Se as a semiconductor material for the low cost production of photovoltaic solar cells was investigated. The Cu/sub 2-x/Se films were produced by coevaporation from individually monitored Cu and Se vapor sources. With a substrate temperature of 170 C, single phase cubic Cu/sub 2-x/Se films were produced. These films had a direct band gap of 2.2 eV and an indirect band gap of 1.4 eV. Both front wall and back wall cells were made. A theoretical computation on the thin film Cu/sub 2-x/Se/CdS cell has indicated an achievable efficiency of greater than 10%. DOE

N80-28896# Oak Ridge National Lab., Tenn. Solid State Div.
CHARACTERIZATION OF ION IMPLANTED, LASER ANNEALED SILICON FOR SOLAR CELL APPLICATIONS
C. W. White 1979 6 p refs Presented at the Am. Nucl. Soc. Meeting, San Francisco, 12 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791103-82) Avail: NTIS HC A02/MF A01

Ion implanted silicon was efficiently annealed using very fast pulses of laser radiation. A wide variety of analytical techniques were used to determine the physical and electrical properties of ion implanted silicon crystals which were annealed using the output of a pulsed ruby laser (energy density approximately 1.5 J/cu cm, 1.5 x 10 to the minus 9th power per sec pulse duration time). Ion channeling measurements and transmission electron microscopy show that there are no extended defects remaining in the implanted region after laser annealing even when the region is made amorphous by implantation. Ion channeling measurements were used to show that dopants occupy electrically active substitutional sites in the lattice after laser annealing even when the dopant concentration greatly exceeds the equilibrium limit of solid solubility. Results are reported.DOE

N80-28897# Oak Ridge National Lab., Tenn.
LASER PROCESSING OF POLYCRYSTALLINE SILICON SOLAR CELLS
R. T. Young, R. F. Wood, J. Narayan, and C. W. White 1979 8 p refs Presented at the Symp. on the Sci. Basis for Nucl. Waste Management, Boston, 26 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791112-55) Avail: NTIS HC A02/MF A01

Ion implantation and pulsed laser annealing were used to produce well controlled dopant regions in polycrystalline Si. Because of the short duration of the laser radiation and because the near surface region of the samples melt, grain boundary diffusion and segregation were eliminated. Solar cells fabricated from cast polycrystalline Si by this technique resulted in open circuit voltages as high as 560 mv and efficiencies as high as 11.6%. DOE

N80-28898# SRI International Corp., Menlo Park, Calif. Engineering Sciences Lab.
LOW-COST PROCESS FOR P-N JUNCTION-TYPE SOLAR CELL Quarterly Technical Progress Report, 1 Dec. 1979 - 29 Feb. 1980
John B. Mooney, Daniel D. Cubiccioti, and Clayton W. Bates, Jr. (Stanford Univ.) Mar. 1980 46 p refs
(Contract EG-77-C-01-4042)
(DSE-4042-T32; QTPR-2) Avail: NTIS HC A03/MF A01

Spray pyrolysis of CuinS2 was studied. The concentration of copper and sulfur in the spray solutions were increased so as to increase the copper content of the films to the stoichiometric level. Although Auger analysis indicates that this was successful, X-ray microanalysis has identified the growth of copper-rich crystals on the surfaces of the deposit. Heat treatment in H2S did not improve the stoichiometry. The copper-rich crystals were also found on a sample sprayed from a solution with no excess copper. Heterojunctions of glass/SnO2(Sb)/CdS/CdTe/carbon (Cu)/Ag-In were prepared with a number of methods used to restrict the junction. The various devices failed to exhibit a diode characteristic or a photoresponse. DOE

N80-28899# SRI International Corp., Menlo Park, Calif. Engineering Sciences Lab.
LOW-COST PROCESS FOR p-N JUNCTION-TYPE SOLAR CELL Quarterly Technical Progress Report, 1 Sep. - 1 Dec. 1979
John B. Mooney Dec. 1979 30 p
(Contract EG-77-C-01-4042)
(SRI-8833-16; QTPR-1) Avail: NTIS HC A03/MF A01

An apparatus was built for the spray pyrolysis of uniform films over areas up to 3 x 4 inches. Procedures were established for the deposition of uniform films of CuInS2. The oxygen content of the films was significantly reduced by substituting nitrogen for air as a propellant and adding a chamber around the spray apparatus to exclude air. Analysis of the films by Auger spectrometry showed that the Cu/In ratio was not uniform throughout the film. While the bulk was nearly stoichiometric, the surface was deficient in copper. Sintered layers of chlorine doped CdTe were prepared. The layers were adherent to the substrate and were about 80 percent of theoretical density. Sintered layers were treated with a copper dipping technique and with graphite. Photoresponse was not observed in the copper treated samples, but a slight photoresponse was observed with graphite. DOE

N80-28900# Oak Ridge National Lab., Tenn. Solar and Special Studies Section
ROOF OVERHANG DESIGN FOR SOLAR CONTROL
Paul R. Barnes 1979 15 p refs Presented at the 4th Natl. Passive Solar Energy Conf., Kansas City, Kas., 3 Oct. 1979
(Contract W-7405-eng-26)
(CONF-791022-15) Avail: NTIS HC A02/MF A01

Design formulas are developed for both fixed and extendable overhangs as a function of window height, geographic latitude, and solar altitude. The extendable overhang is adjusted seasonally. Design parameters are suggested for near optimum solar control in direct gain passive systems. A method of estimating the effect of an overhang on solar gain is also developed. Examples of the solar performance for both fixed and adjustable overhangs are presented for 36 deg N latitude. DOE

N80-28901# Pennsylvania Univ., Philadelphia.
POLYACETYLENE, (CH)/SUB X/, AS AN EMERGING MATERIAL FOR SOLAR CELL APPLICATIONS Technical Progress Report, Oct. - Dec. 1979
A. J. Heeger and A. G. MacDiarmid 14 Feb. 1980 25 p refs
(Contract DE-AC04-79ET-23002)
(DOE/ET-23002/T7; QPR-3) Avail: NTIS HC A02/MF A01

Initial studies of p-n heterojunctions formed between undoped trans CH sub x and n-Cds are reported. The junctions were characterized by measurements of current vs voltage, capacitance vs voltage, and photovoltaic response spectra. The results are analyzed in terms of the standard heterojunction equations. It is concluded that undoped as-grown films of trans CH sub x are p-type with a residual acceptor concentration of 2 x 10 to the 18th power per cu cm, and that in spite of the complex fibril morphology the semiconductor properties can be inferred by treating CH sub x as an effective homogeneous medium. Detailed studies of the photovoltaic response at energies below the energy gap for CH sub x imply the existence of a well defined, deep trapping state in polyacetylene with an energy near the center of the gap. DOE

N80-28902# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
COST-EFFECTIVE WAYS TO IMPROVE THE FABRICATION AND INSTALLATION OF SOLAR HEATING AND COOLING SYSTEMS FOR RESIDENCES Final Report, 1 Jun. 1977 -

30 Sep. 1978
Sanford B. Thayer, Peter Jacobs, and Norman Weaver Oct. 1978 134 p refs
(Contract EG-77-S-02-4520)
(COO-4520-1) Avail: NTIS HC A07/MF A01

A study investigating cost effective ways of improving fabrication and installation of residential solar energy heating systems is documented. The study entailed on-site observation of twelve installations focusing on the phase of mounting and manifolding of solar collectors. Time lapse photography and work measurement techniques were employed to record these installations. Generic collector types studied included air and liquid panels both internally and externally manifolded. Principal findings of the study synthesized from field observations, analysis of photographic data, time studies, and discussion with installation personnel and manufacturers' representatives are presented in the technical report. DOE

N80-28903# Carnegie-Mellon Univ., Pittsburgh, Pa. Physics Dept.
FOAM OTEC SYSTEM
Clarence Zener and Martin Greenstein Jul. 1979 21 p Presented at the 6th OTEC Conf., Washington, D.C., 19 Jun. 1979
(Contract EG-77-S-02-4459)
(CONF-790631-13) Avail: NTIS HC A02/MF A01

An attempt was made to incorporate the main features of a foam Ocean Thermal Energy Conversion system. These features included foam generation, foam rise, foam breaking, and finally separation of liquid and vapor. Our foam generator formed foam at rates as high as would be desired in a commercial plant, approximately 1 gram/cu cm/sec. The rise of the foam, accompanied by a drop in temperature, was as expected by theory. The foam breaking, and the subsequent separation of liquid and vapor, presented no problem. The dominant role played by the wall drag in the 4 diameter, 30 high column was totally unexpected. Experiments were consistent, however, with a very simple expression for the variation of the drag coefficient with the foam parameters of mass flow rate and density. For the large diameter columns envisioned for commercial plants, wall drag will play only a minor role. Likewise, the large surfactant concentration (approximately 1000 ppM) required to maintain complete foam-stability to the top of the column was unexpected. DOE

N80-28904# Carnegie-Mellon Univ., Pittsburgh, Pa.
THERMALLY INDUCED FLOW OF HIGH EXPANSION AQUEOUS FOAM IN A VERTICAL PIPE
Martin Greenstein and Clarence Zener 1979 39 p ref Presented at the 6th OTEC Conf., Washington, D.C., 19 Jun. 1979
(Contract EG-77-S-02-4459)
(CONF-790631-14) Avail: NTIS HC A03/MF A01

Foam was generated by air injection into an aqueous surfactant solution. Cooling from about 25 C to about 15 C, the foam flowed through a 30' high, 4' diameter glass column. At the top of the column, an alcohol drip broke the foam. A cold water direct contact condenser backed by a rotary vacuum pump eliminated the air and water vapor released from the ruptured foam cells. A differential equation involving a single empirical parameter described the flow. The dependence of this parameter on flow rate indicated that the foam flow had a dissipative loss similar to that of laminar flow of liquids in pipes. DOE

N80-28905# Boston Univ., Mass. Dept. of Chemistry.
ORGANIC PHOTOCHEMICAL STORAGE OF SOLAR ENERGY Progress Report, 1 Feb. 1979 - 31 Jan. 1980
Guilford Jones, II Feb. 1980 17 p refs
(Contract EG-77-S-02-4380)
(COO-4380-3) Avail: NTIS HC A02/MF A01

The quenching of fluorescent sensitizers by isomerizable substrates results in the formation of excited complexes. These sensitizer substrate pairs are highly polarized, leading to changes in bond order for the substrates. For several substrates this perturbation results in efficient valence isomerization. Isomerization observed on irradiation of charge transfer complexes of isomerizable substrates is consistent with a similar exciplex - template mechanism. The energy transfer mechanism of photosensitization was studied by measuring the temperature dependence of quantum yield for isomerization of dimethyl norbornadiene-2,3-dicarboxylate sensitized by benzanthrone. From temperature and quencher concentration profiles quenching constants were obtained which are consistent with an endoergic triplet energy transfer mechanism. The thermal upconversion of the low energy triplet of benzanthrone results in a threefold increase in isomerization quantum yield over a 90 deg temperature range. DOE

N80-28906# Ueland and Junker, Architects and Planners, Philadelphia, Pa.
SOLAR ATRIUM: A HYBRID SOLAR HEATING AND COOLING SYSTEM Technical Progress Report, 19 Jun. - 19 Sep. 1979
Mark Ueland 28 Sep. 1979 10 p
(Grant EG-77-G-04-4135)
(ALO-4135-T1; TPR-8) Avail: NTIS HC A02/MF A01

The design, construction, and monitoring of an innovative concept of solar heating and cooling called solar atrium is described. The solar atrium concept is adaptable to residences and smaller commercial and institutional buildings. It is designed to be constructed of materials and equipment that are economical and readily available. Cost effectiveness of installation and operation is a primary design objective. The solar atrium incorporates the large glass areas of the earlier houses and adds facilities for heat storage and control of heat losses through glass. DOE

N80-28907# RCA Labs., Princeton, N. J. Energy Systems Research Labs.
THIN-FILM POLYCRYSTALLINE SILICON SOLAR CELLS Final Report, 11 Sep. 1978 - 10 Sep. 1979
B. W. Faughnan Nov. 1979 75 p refs
(Contract DE-AC03-78ET-20562)
(DOE/ET-20562/4; PRRL-79-CR-48) Avail: NTIS HC A04/MF A01

The effect of grain boundaries on the performance of solar cells fabricated on Wacker Silso polycrystalline silicon substrates is studied. Efficiencies of 8% (no antireflection coating) were obtained (11.2% with AR coating). This is 20% lower than the efficiency obtained for identically fabricated single crystal cells. This reduction can be accounted for as follows: 4% reduction in V sub oc due to grain boundaries, 8% reduction in J sub sc due to a lower minority carrier diffusion length inside the grains. Quantum efficiency measurements were made with a 150 micron diameter light spot inside grains and across grain boundaries, permitting a determination of L sub n inside a grain (L sub n = 75 microns for Wacker Silso). Laser scans were obtained at lambda = 0.633 micron and at 1.15 microns. Some grain boundaries are shown to be electrically inactive. Active grain boundaries were also observed by a novel liquid-crystal technique. DOE

N80-28908# Motorola, Inc., Scottsdale, Ariz. Government Electronics Div.
LOW-COST PHOTOVOLTAIC CELL MOUNT STUDY Final Report
Albuquerque, N. Mex. Sandia Labs. Mar. 1980 65 p
(Contract EY-76-C-04-0789)
(SAND-80-7006) Avail: NTIS HC A04/MF A01

The development of a low cost photovolatic concentrator cell mount is described. A technical and economic evaluation of five representative cell laydown techniques is given with the final goal being a determination of which was most promising from a cost performance basis. The five considered designs are representative of currently employed or proposed laydown techniques: (1) flexible adhesive hold down of the cell; (2) soldering the cell to a metallized alumina wafer; (3) soldering the cell to a plasma-sprayed copper and alumina substrate; (4) soldering the cell to a plasma-sprayed alumina/copper laminated substrate; and (5) soldering the cell to a metallized porcelain wafer. Tabular summaries are given for the economic and technical performance of each mounting technique. Conclusions are made concerning which design is most cost effective and comments on manufacturing and technical considerations of each mount are presented. Also, tests of an innovative heat dissipation system for passively cooling solar cells employing a reflux cooler panel based on the heat pipe concept are described. DOE

N80-28908# Los Angeles City Dept. of Water and Power, Calif.
SUN VALLEY PHOTOVOLTAIC POWER PROJECT, PHASE 1 Final Report, 1 Jun. 1978 - 28 Feb. 1979
Frank R. Goodman, Jr. Mar. 1980 166 p refs
(Contract ET-78-C-04-4281)
(ALO-4281-1) Avail: NTIS HC A08/MF A01

An application experiment was devised for fabrication installation, operation, and evaluation of a concentrating photovoltaic system for direct conversion of sunlight to electricity. The photovoltaic system was connected to an electric motor load and to an electric utility system. Provisions were made to allow the motor load to be supplied with power from either the photovoltaic system or the utility system. When the demand of the motor load was low, the photovoltaic system delivered excess power to the utility system for use elsewhere. Thus, the experimental installation was designed with sufficient flexibility to enable several modes of operation to be evaluated. DOE

N80-28910# Institute of Gas Technology, Chicago, Ill.
ELECTROCHEMICAL PHOTOVOLTAIC CELLS, PROJECT 65021
Peter G. P. Ang and Anthony F. Sammells Oct. 1979 35 p refs
(Contracts EG-77-C-01-4042; XP-9-8002-5)
(DSE-4042-T8) Avail: NTIS HC A03/MF A01

The photoelectrochemical performance of single crystal MoSe2 and GaAs, polycrystalline CdSe, and cells with RbAg4I5 solid electrolyte were evaluated. The MoSe2 electrode exhibited very good photoresponse in electrolytes containing Br(-)/Br2 redox couple. The photopotential and photocurrent were larger in acid than in alkaline electrolyte. A power conversion efficiency of about 5% was achieved under 200 mW cucm> xenon light illumination in the acid medium. The catalytic activity of a platinized platinum electrode toward Br(-) redox couple was also better in acid electrolyte than in alkaline electrolyte. Higher current densities were obtained in the acid medium. The NoSe2 was found to have good stability in acid and alkaline electrolytes, however, it will be necessary to protect the electrolyte against evaporation of the bromine, oxidation by air, or photodecompositions. DOE

N80-28911# Commission of the European Communities, Brussels (Belgium).
ENERGY. APPLICATION OF SOLAR ENERGY IN DWELLINGS: A TECHNICAL AND ECONOMICAL ANALYSIS FOR THE EUROPEAN COMMUNITY
1980 183 p refs
(EUR-6669) Avail: NTIS (US sales only) HC A09/MF A01

The technical possibilities and economical limitations of solar heating systems for the application in swimming pools, hot water preparation, space heating and air conditioning were investigated. This analysis was performed for dwellings with special consideration of the climatic differences in each community. The computer program, which was used for solar system calculations, and all mathematical models, for technical and economical analysis were elucidated. In the technical and economical analysis, the most suitable solar system sizes for each community was determined. Four types of solar collectors were investigated. The single glass selective collector proved to be the most cost effective collector in all the above applications, provided the the additional cost for the selective coating is not more than 20 DM/cu. From the results of the analysis certain recommendations were derived, which can improve the rapid implementation of solar heating systems into the market. DOE

N80-28912# Edgerton, Germeshausen and Grier, Inc., Albuquerque, N. Mex.
CONCENTRATING SOLAR COLLECTOR TEST RESULTS
Vernon E. Dudley and Robert M. Workhoven 1980 5 p refs Presented at the Am. Sect. of the Intern. Solar Energy Soc. Conf., Phoenix, Ariz., 2 Jun. 1980 Prepared in cooperation with Sandia Labs., Albuquerque, N. Mex.
(Contract EY-76-C-04-0789)
(SAND-80-0801C; CONF-800604-5) Avail: NTIS HC A02/MF A01

Some of the results obtained from three years of testing concentrating solar collectors at Sandia National Laboratories are summarized. Efficiency and thermal loss test data is for 16 collectors from 11 different manufacturers. DOE

N80-28913# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Chemical Engineering.
DESIGN OF LAND-BASED, FOAM OTEC PLANTS FOR BOTTOMING CYCLES
A. E. Molini, C. Zener, and T. Fort, Jr. 1979 6 p refs Presented at 6th OTEC Conf., Washington, D.C., 19 Jun. 1979 Prepared in cooperation with Univ. of Puerto Rico, Mayaguez
(Contract EG-77-S-02-4459)
(CONF-790631-17) Avail: NTIS HC A02/MF A01

The Foam Energy Recovery Open Cycle System (FEROCS) at a 1 MW to 10 MW scale is described. A structural design was initiated for a unit 380 ft high visualized as an inverted, vertical, reinforced concrete U tube of 36 ft I.D. and walls 11 in. thick. The structure is feasible based on present construction practices with reinforced concrete in Puerto Rico. It would cost approximately $1.4 million and consume 3800 cu yds of concrete and 860 tons of reinforcing steel. To accelerate the demonstration of FEROCS, it is proposed to utilize artifically created temperature differences that can be readily obtained between industrial thermal effluents, for example flue gases at greater than 250 F from fossil fuel fired steam generating plants, as the heat source and ambient air as the heat sink. Results are presented of a study made conceptualizing the process using different scrubbing-working fluids. DOE

N80-28914# Sandia Labs., Albuquerque, N. Mex. Exploratory Batteries Div.
MODIFIED Li/SO2 CELLS FOR LONG-LIFE APPLICATIONS
Samual C. Levy 1980 14 p refs Presented at the 20th Power Sources Conf., Atlantic City, 9 Jun. 1980
(Contract EY-76-C-04-0789)
(SAND-79-2292C; CONF-800612-2) Avail: NTIS HC A02/MF A01

A 6 year test program to evaluate an ambient-temperature Li primary battery was initiated on cells from two manufacturers. Three modes of premature failure were observed in Li/SO2 cells: corrosion of the lithium-to-can contact, corrosion of the glass in the glass-to-metal seal in the header, and corrosion at the Al-Ta weld in the positive lead. Potential fixes for each of these failure modes were incorporated into cells from two suppliers, and accelerated tests of these cells have begun. DOE

N80-28915# Variflex Corp., Washington, D.C.
WORLDWIDE TRANSPORTATION/ENERGY DEMAND, 1975-2000: REVISED VARIFLEX MODEL PROJECTIONS
Robert U. Ayres and L. W. Ayres Mar. 1980 176 p refs
(Contract W-7405-eng-26)
(ORNL/Sub-79/45740/1) Avail: NTIS HC A09/MF A01

The salient features of the transportation energy relationships that characterize the world of 1975 are reviewed, and worldwide (34 countries) long-range transportation demand by mode to the year 2000 is reviewed. A worldwide model is used to estimate future energy demand for transportation. Projections made by the forecasting model indicate that in the year 2000, every region will be more dependent on petroleum for the transportation sector than it was in 1975. Trends are highlighted and areas for further investigation are suggested. Forecast methodology and model output are described in detail. DOE

N80-28916# Minnesota Univ., Minneapolis. Dept. of Mechanical Engineering.
FUNDAMENTAL HEAT TRANSFER PROCESSES RELATED TO PHASE CHANGE THERMAL STORAGE MEDIA
E. M. Sparrow and J. W. Ramsey Mar. 1980 15 p refs
(Contract DE-AC02-79ER-10343)
(DOE/ER-10343/1) Avail: NTIS HC A02/MF A01

Fundamental heat transfer processes which occur in phase change thermal storage systems are investigated. Four problems were investigated, two involving freezing and two involving melting. It was found that under certain operating conditions, freezing can be drastically retarded and even terminated by natural convection. Under other operating conditions, the dominance of natural convection in the freezing process ultimately gives way

to a freezing mode controlled by heat conduction in the solidified material. By taking account of geometrical and thermal symmetry, the relationship between freezing about a single vertical tube and about an array of vertical tubes was established. The melting studies were focused on determining quantitative data for the heat transfer coefficients in two basic phase-change systems. One of these is an array of horizontal tubes and the other is a single vertical tube. The experiments involved parametric variations of the heating rate and of the degree of subcooling of the melting solid. DOE

N80-28917# Ad-Ex International, Portola Valley, Calif.
METAL-AIR BATTERY WITH REPLACEABLE ANODES
Nov. 1979 7 p Transl. into ENGLISH of Yugoslavian Technical Report Sponsored by DOE Prepared for California Univ., Livermore, Lawrence Livermore Lab.
(UCRL-Trans-11533) Avail: NTIS HC A02/MF A01

A technique for the replacement of anodes in a metal (aluminum, magnesium, etc.)-air battery with consumable electrodes is described. In order to maintain a constant distance between the anode and cathode, the battery must be designed so that, by use of a spring, for example, one of the electrodes is pushed toward the other in such a way that it is constantly pressed down against a distance gage (spacer) that is inserted between them. This invention solves both the problem of anode replacement and the problem of maintaining a constant distance in a very simple fashion. DOE

N80-28918# Electric Power Research Inst., Palo Alto, Calif.
ENERGY ECONOMIC PROJECTIONS FOR THE 1979 OVERVIEW
Louise D. Cleary Sep. 1979 130 p refs
(EPRI-PS-79-5-LD) Avail: NTIS HC A07/MF A01

Each year the EPRI Planning Staff publishes an overview to the 5 year research and development program plan. This report elaborates on and documents key energy demand and supply, economic, and financial issues analyzed in the Overview and Strategy 1980-1984 Research and Development Program Plan, EPRI-1141-PS. The report begins with a summary and expansion of energy and economic issues presented in the planning factors section of the Overview keyed to ETA-MACRO and WEM results. It is followed by an alternative view on the benefits of R and D planning. Next, key assumptions used in the models are outlined. Finally, sensitivity cases explore the implications of a moratorium on the construction of new nuclear plants in the US. Copies of the ETA-MACRO computer input and output from the Overview scenarios are available. DOE

N80-28919# Department of Energy, Washington, D. C. Office of Current Reporting.
INTERNATIONAL ENERGY INDICATORS
Elizabeth K. Bauer, ed. Mar. 1980 30 p
(DOE/IA-0001T/3(80)) Avail: NTIS HC A03/MF A01

For the international sector, a table of data is first presented followed by corresponding graphs of the data for the following: (1) Iran: crude oil capacity, production, and shut in, 1974 to February 1980; (2) Saudi Arabia (same as Iran); (3) OPEC (ex-Iran and Saudi Arabia): capacity, production, and shutin, 1974 to January 1980; (4) non-OPEC Free World and US production of crude oil, 1973 to January 1980; (5) oil stocks: Free World, US, Japan, and Europe (landed), 1973 to 1979; (6) petroleum consumption by industrial countries, 1973 to October 1979; (7) USSR crude oil production, 1974 to February 1980; (8) Free World and US nuclear generation capacity, 1973 to January 1980. For the United States, the same data format is used for the following: US imports of crude oil and products 1973 to January 1980; landed cost of Saudi Arabia crude oil in current and 1974 dollars, 1974 to October 1979; US trade in coal, 1973 to 1979; summary of US merchandise trade, 1976 to January 1980; and US energy/GNP ratio (in 1972 dollars), 1947 to 1979. DOE

N80-28920# Brookhaven National Lab., Upton, N. Y. Electrochemical Technology Group.
FUEL CELL APPLIED RESEARCH: ELECTROCATALYSIS AND MATERIALS Quarterly Report, 1 Jul. - 30 Sep. 1978
S. Srinivasan, H. S. Isaacs, W. E. OGrady, H. Olender, L. J. Olmer, K. Daube, and K. V. Kordesch Jun. 1979 30 p refs
(Contract EY-76-C-02-0016)
(BNL-51053) Avail: NTIS HC A03/MF A01

The electrocatalysis of the formic acid and methanol oxidation reactions at underpotentially deposited metal surfaces at 25 C was investigated. The test electrode was a smooth polycrystalline platinum disc, on which a metal Bi, Cd, Pb or Tl was underpotentially deposited (UPD) by potential cycling in 1 N HClO. The organic reactant (HCOOH or CH3OH) was added to this electrolyte so that its concentration was 0.26 M. Cyclic voltammograms were recorded on the Pt (control) and on the UPD test electrodes at a sweep rate of 50 mV/sec in the potential range of 0 to 1.45 V/RHE. Overpotentials in solid electrolyte fuel cells were also studied. Alternating and direct current techniques were used to determine the impedance characteristics at the platinum-yttria stabilized zirconia interface in the regions of potentials where the oxygen evolution and reduction reactions take place. DOE

N80-28921# Ad-Ex International, Portola Valley, Calif.
ALUMINUM-AIR BATTERY
A. Despic (Belgrade Univ.), D. Drazic (Belgrade Univ.), and S. Zecevic Nov. 1979 12 p refs Transl. into ENGLISH from Yugoslavian Report
(UCRL-Trans-11536) Avail: NTIS HC A02/MF A01

Aluminum alloyed with small amounts (less than 0.1%) of In, Ga, and Tl in an aluminum air battery with 2M NaCl as the electrolyte is reported. The tested laboratory model of the battery with a total weight of about 500 g operated at a total current of 8 A (j = 30 mA/cu cm) and a voltage of about 1 V for 7 hours. Replacing the electrolyte increased the discharge time severalfold, with the number of replacements depending on the selected initial thickness of the Al anode. It is shown that optimizing the design permitted up to 500 Wh/kg to be attained with periodic replacement of the electrolyte, or about 100 Wh/kg without replacement of the electrolyte. A number of suitable uses for this battery, especially for special purpose batteries, are suggested. DOE

N80-28922# Ad-Ex International, Portola Valley, Calif.
NEW RESULTS IN DEVELOPMENT OF ALUMINUM-AIR BATTERIES WITH A NEUTRAL ELECTROLYTE
D. M. Drazic, A. R. Despic, S. Zecevic, L. Jovanovic, and L. Gajic Nov. 1979 11 p refs Transl. into ENGLISH from Yugoslavian Report
(UCRL-Trans-11532) Avail: NTIS HC A02/MF A01

The electrochemistry of Al anodes in 2M NaCl was investigated. The anode was shifted up and down mechanically at various amplitudes and frequencies. It was found that anodes made from commercial grade Al (99.5%) were less suitable than those made from pure Al (99.99%) due to the presence of Cu impurity; if the use of pure Al is to be avoided, some way to neutralize the harmful effects of the impurity must be found. The amount of Al that can dissolve in the electrolyte, and thus the lifetime of the battery, depends on the dynamic conditions in the battery; during vibration of the battery the electrolyte can hold up to 0.18 g/ml without passivation of the anode. This result indicates that a 10 kW battery with an interelectrode distance of 5 mm can continually discharge with a current density of 50 mA/sq cm for 6 hours. If sufficiently thick anodes were used, it could then be prepared for a new discharge cycle simply by replacement of the electrolyte. DOE

N80-28923# Ad-Ex International, Portola Valley, Calif.
ANODIC BEHAVIOR OF Al AND THE ALLOYS Al-In AND Al-In-Ga IN ALUMINUM-AIR BATTERIES
D. M. Drazic (Belgrade Univ.), A. R. Despic (Belgrade Univ.), and S. K. Zecevic Nov. 1979 12 p refs Transl. into ENGLISH from Yugoslavian Report
(UCRL-Trans-11534) Avail: NTIS HC A02/MF A01

The anodic behavior of aluminum and the alloys Al-In and Al-In-Ga was tested under the operating conditions of aluminum-air batteries. The tests were conducted in an aqueous solution of 2 M NaCl, and the results obtained were compared with the results obtained from a special test of these alloys as the anode in a standard electrochemical cell. Significant results and observations are reported. DOE

N80-28924# Martin Marietta Aerospace, Denver, Colo.
INTERNALLY INSULATED THERMAL STORAGE SYSTEM

DEVELOPMENT PROGRAM Final Report
Dec. 1979 172 p refs
(Contract EY-76-C-04-0789)
(SAND-80-8175; MCR-79-1369) Avail: NTIS *HC A08/MF A01*

A cost effective thermal storage system for a solar central receiver power system using molten salt stored in internally insulated carbon steel tanks was defined. The program was divided into five tasks: (1) testing of internal insulation materials in molten salt; (2) preliminary design of storage tanks, including insulation and liner installation; (3) thermal analysis of internally insulated thermocline tanks; (4) optimization of the storage configuration; and (5) definition of a subsystem research experiment to demonstrate the system. DOE

N80-28925# Rockwell International Corp., Golden, Colo. Energy Systems Group.
ALTOS-MODEL 8B WIND TURBINE GENERATOR. FAILURE ANALYSIS
K. K. Higashi and M. J. Carr 18 Jun. 1979 20 p
(Contract DE-AC04-76DP-03533)
(RFP-3035/3533/79-10) Avail: NTIS HC A02/MF A01

The failure of the Altos wind turbine generator is investigated. A brittle failure of a hub was caused by the combination of a poor quality (porous) casting and a sharp corner in a machined keyway. DOE

N80-28926# Rockwell International Corp., Golden, Colo. Energy Systems Group.
ALTOS-MODEL 8B WIND TURBINE GENERATOR. PERFORMANCE REPORT Interim Report
K. K. Higashi Jul. 1979 13 p
(Contract DE-AC04-76DP-03533)
(RFP-3033/3533/79-4) Avail: NTIS HC A02/MF A01

A wind turbine generator was tested in terms of its performance under conditions which it is likely to be subjected while in normal use. All instruments used during the testing were maintained in calibration and accordance with Rocky Flats calibration procedures. DOE

N80-28927# Sandia Labs., Albuquerque, N. Mex.
ACCELERATED AGING OF THERMALLY ACTIVATED BATTERIES WHICH UTILIZE THE Li(Si)/LiCl-KCl/FeS2 SYSTEM
Jimmie Q. Searcy and Patricia A. Neiswander 1980 23 p *refs Presented at the 29th Power Sources Conf., Atlantic City, 9 Jun. 1980*
(Contract EY-76-C-04-0789)
(SAND-80-5080C; CONF-800612-1) *Avail: NTIS* HC A02/MF A01

A number of Li(Si)/FeS2 thermally activated batteries were developed for applications that require high reliability and a shelf life of twenty-five years. An accelerated aging study was undertaken to determine the feasibility of achieving the requirements. Deleterious chemical reactions were identified that could affect performance and reliability during the twenty-five year shelf life. The approach used was to accelerate the aging of batteries by storage at elevated temperature, and then to examine and analyze materials from some batteries, while discharging others. A battery design that used no organic materials (except for those in an electrical match) was chosen in order to minimize the number of possible deleterious reactions. The reaction of Li(Si) with water outgased from the various battery parts was the only effect deleterious to shelf life that was noted. DOE

N80-28928# Ueland and Junker, Architects and Planners, Philadelphia, Pa.
SOLAR ATRIUM: A HYBRID SOLAR HEATING AND COOLING SYSTEM Technical Progress Report, 19 Dec. 1978 - 19 Mar. 1979
Mark Ueland 19 Mar. 1979 11 p
(Contract EG-77-G-04-4135)
(DOE/CS-34135/6; TPR-6) Avail: NTIS HC A02/MF A01

The design, construction and monitoring of an innovative concept of solar heating and cooling are described. The concept is adaptable to residences and smaller commercial and institutional buildings. It is designed to be constructed of materials and equipment that are economical and readily available. Progress on construction is reported. DOE

N80-28929# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Dept. Satellites.
THE SNIAS MAGNETIC BEARING WHEEL [LES ROUES A PALIERS MAGNETIQUES DE L'AEROSPATIALE]
Claude Rouyer Paris 1979 21 p In FRENCH Presented at Colloq. PROSPACE, Moscow, 10-14 Sep. 1979
(SNIAS-792-421-101) Avail: NTIS HC A02/MF A01

The use of the magnetic bearing for momentum and reaction wheels in satellites is discussed. A description of the specifications and characteristics required is given. The principles of magnetic bearings are given and a specific model is presented. A comparison is made between the advantages and disadvantages of ball and magnetic type bearings. Space and terrestrial application (such as energy storage and recuperation) are foreseen. Author (ESA)

N80-28930# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Dept. Etudes Speciales.
PASSIVE RADIALLY CENTERED MAGNETIC SUSPENSION FOR HIGH VELOCITY ROTORS [SUSPENSION MAGNETIQUE A CENTRAGE RADIAL PASSIF POUR ROTORS A GRANDE VITESSE]
Pierre C. Poubeau Paris 1979 28 p refs In FRENCH Presented at SEE Conf. Journees d'Etudes pour les Nouveaux Mater. Magnetiques, Grenoble, 20-21 Apr. 1978
(SNIAS-792-422-109) Avail: NTIS HC A03/MF A01

A suspension system developed for the attitude governing flywheels of satellites is presented. Samarium cobalt magnetic crown pieces assure centering; a single servomechanism stabilizes the axial equilibrium of the rotor. Friction problems are eliminated in this system which enables velocities to be achieved that are only limited by the centrifugal forces experienced by the rotor material. This system is thus associated with rotors made of composite materials. Author (ESA)

N80-28931# Technische Hogeschool, Eindhoven (Netherlands). Dept. of Electrical Engineering.
A PARAMETRIC STUDY OF 1000 MWe COMBINED CLOSED CYCLE MHD/SYSTEM ELECTRICAL POWER GENERATING PLANTS
A. J. Geutjes and D. Kleyn Dec. 1978 60 p refs
(TH-78-E-91; ISBN-90-6144-091-2) Avail: NTIS HC A04/MF A01

A parametric study was carried out for different closed noble gas MHD cycles coupled to a direct coal-fired combustion system (and in most cases to a steam bottoming plant). For the description of the components, black-box models were used. The influence of the choice of the most important design parameters on the total system efficiency was quantified, and the performance of systems compared with different configuration. The so-called topping-cycle makes the best system with an efficiency of 52% for a base case. A parametric study was done with respect to channel properties to find an optimal system efficiency for both supersonic and subsonic channels as part of a topping-cycle. The generator properties were calculated according to a quasi one dimensional model. Author (ESA)

N80-28932# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
MOMENTUM THEORY ANALYSIS OF UNCONVENTIONAL WIND EXTRACTION SCHEMES, PART 10
Marten T. Landahl Stockholm Aeron. Res. Inst. of Sweden 12 Oct. 1979 23 p refs 6 Vol.
(Contract SWEDBESD-5061-012)
(ASRL-TR-194-2-Pt-10; FFA-AU-1499-Pt-10) Avail: NTIS HC A02/MF A01

A momentum theory analysis was carried out for idealized wind energy extraction devices under the assumption of uniform wake velocity. The wind energy extraction problem was analyzed on the basis of some simple idealized flow models which demonstrate that the 'Bertz limit' can be exceeded with the aid of some unconventional extraction schemes. However, to what extent such schemes could be realized in actual engineering designs is not discussed. It is shown that by deflecting the flow through the extractor, it is theoretically possible to extract a

power per unit frontal area of the extractor which is considerably (by about a factor of two) higher than that given by the simple actuator disk model. Author (ESA)

N80-28933# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

SAFETY OF WIND ENERGY CONVERSION SYSTEMS (WECS): PRELIMINARY STUDY

Sigge Eggwertz, Ingemar Carlsson (LUTAB Ingenjoersbryaa AB), Anders Gustafsson, Christer Lundemo, Bjoern Montgomerie, and Sven-Erik Thor 16 Nov. 1979 136 p refs

(Contract SWEDBESD-5061-101)

(FFA-HU-2126) Avail: NTIS HC A07/MF A01

A safety study to provide information on the risks inherent in a Wind Energy Conversion System (WECS) to the general public in the surrounding area as well as to the operator personnel is presented. Land based large scale turbine systems with horizontal axes situated in sparsely populated areas are considered. The study is intended to serve as a preliminary manual for safety analysis of WECS. An overall description of the system, statistical information concerning loads and strength properties of materials considered, and a discussion of geometrical tolerances are included. Formulas and procedures to be employed in the risk analysis are presented, followed by comments on acceptable risk levels. The consequences of components failures are also considered. A dynamic analysis of separating objects is performed. Critical events are listed, while safety systems, inspection, and repairs are discussed. Author (ESA)

N80-28934# New England River Basins Commission, Boston, Mass.

POTENTIAL FOR HYDROPOWER DEVELOPMENT AT EXISTING DAMS IN NEW ENGLAND. VOLUME 1: PHYSICAL AND ECONOMIC FINDINGS AND METHODOLOGY Final Report

Jan. 1980 181 p

(PB80-169121; HP-1-80/1) Avail: NTIS HC A09/MF A01 CSCL 10B

The potential for hydropower development at existing dams in New England was investigated. The extent to which New England's dependence on foreign oil could be reduced through expansion of hydropower at existing dams is quantified in terms of energy and costs. A synopsis of the study methodology is presented. GRA

N80-28935# New England River Basins Commission, Boston, Mass.

POTENTIAL FOR HYDROPOWER DEVELOPMENT AT EXISTING DAMS IN NEW ENGLAND. VOLUME 2: USER'S MANUAL Final Report

Jan. 1980 141 p

(PB80-169139; HD-1-80/2) Avail: NTIS HC A07/MF A01 CSCL 10B

The computer program HYELEC and its subroutines HYDPOT and ECOPOT is presented. HYELEC stores information relating to the hydropower potential of dams and can perform screening and ranking operations on these dams according to selected criteria pertaining to engineering practicability and economic feasibility. The computer language, the use of program control variables, and the sequence of events required for program operation are described. GRA

N80-28936# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.

AN INVESTIGATION OF WIND LOADS ON SOLAR COLLECTORS Final Report

H. W. Tieleman, R. E. Akins, and P. R. Sparks Jan. 1980 169 p refs

(Contract EO-A01-78-3605)

(PB80-158744; VPI-E-80-1) Avail: NTIS HC A08/MF A01; also available in set of 3 reports HC E14, PB80-158736 CSCL 10A

A wind-tunnel study of a series of model solar collector installations (flat-plate collectors) immersed in a thick turbulent shear layer was undertaken in order to determine design wind loads on such installations. Wind tunnel measurements were made of the mean and fluctuating pressures on a model of a single flat-plate collector which was a component of different multi-panel installations. The pressures were spatially integrated over the top and bottom surface of the single collector separately. GRA

N80-28937# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.

AN INVESTIGATION OF WIND LOADS ON SOLAR COLLECTORS. APPENDIX 1: DATA LISTING FOR TOP AND BOTTOM OF COLLECTOR Final Report

H. W. Tieleman, R. E. Akins, and P. R. Sparks Jan. 1980 312 p refs

(Contract EO-A01-78-3605)

(PB80-158751; VPI-E-80-1-App-1) Avail: NTIS HC A14/MF A01; also available in set of 3 reports HC E14, PB80-158736 CSCL 10A

A wind-tunnel study of a series of model solar-collector installations (flat-plate collectors) immersed in a thick turbulent shear layout was undertaken in order to determine design wind loads on such installations. The complete results of all wind tunnel model tests are presented in tabular and graphical form. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-28938 Greater London Council (England).

HEAVY METALS IN TERRESTRIAL ECOSYSTEMS: A BIBLIOGRAPHY

E. C. Goodliffe, comp. Nov. 1978 27 p refs

(ISBN-7168-1061-1) Copyright. Avail: Greater London Council, London £1.75

An annotated bibliography was compiled which includes metal pollution from industrial sources, road traffic sources, the biological/ecological consequences of heavy metal pollution, and heavy metals in soils. Author (ESA)

N80-28939*# University of Central Florida, Orlando.

A CONTINUATION OF BASE-LINE STUDIES FOR ENVIRONMENTALLY MONITORING SPACE TRANSPORTATION SYSTEMS AT JOHN F. KENNEDY SPACE CENTER. VOLUME 3, PART 1: ICHTHYOLOGICAL SURVEY OF LAGOONAL WATERS Final Report

F. F. Snelson, Jr. Jul. 1980 436 p refs

(Contract NAS10-8986)

(NASA-CR-163122; KSC-TR-51-2-Vol-3-Pt-1) Avail: NTIS HC A19/MF A01 CSCL 13B

Ichthyological species in the Indian River lagoonal system likely to be affected by NASA's aerospace activities at the Kennedy Space Center were surveyed. The importance of the fish found to inhabit the waters in the area is analyzed. A.R.H.

N80-28940*# University of Central Florida, Orlando.

A CONTINUATION OF BASE-LINE STUDIES FOR ENVIRONMENTALLY MONITORING SPACE TRANSPORTATION SYSTEMS AT JOHN F. KENNEDY SPACE CENTER. VOLUME 3, PART 2: ICHTHYOLOGICAL STUDIES, SAILFIN MOLLY REPRODUCTION STUDY Final Report

F. F. Snelson, Jr. Jul. 1980 182 p refs

(Contract NAS10-8986)

(NASA-CR-163122; KSC-TR-51-2-Vol-3-Pt-2) Avail: NTIS HC A09/MF A01 CSCL 13B

The applicability of monitoring populations of Poccilia latipinna (sailfin molly) and its reproductive efforts as reliable indicators of environmental effects of aerospace activities in the Kennedy Space Center area was investigated. Results show that the sailfin molly experiences drastic fluctuations in population and reproductive success and is not an appropriate factor for monitoring to establish perturbations of the environment due to space transportation system related activities. A.R.H.

N80-28941*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

GROUND CLOUD HYDROGEN CHLORIDE MEASUREMENTS FROM THREE TITAN LAUNCHES AT THE KENNEDY

SPACE CENTER DURING 1978 AND 1979
Daniel L. Seabacher, Robert B. Lee, III, and Joseph J. Mathis Jun. 1980 48 p refs
(NASA-TM-81830) Avail: NTIS HC A03/MF A01 CSCL 13B

Total hydrogen chloride and gaseous hydrogen chloride concentrations were measured in the exhaust cloud produced at three Titan 3 launches at the Kennedy Space Center in March 1978, December 1978, and November 1979 to determine the degree of hydrogen chloride partitioning in a solid rocket exhaust cloud between gaseous hydrogen chloride and hydrochloric acid aerosol as a function of ambient relative humidity. Moderately low relative humidity conditions were present during a daytime launch on Mar 25, 1978, and high relative humidity conditions were present during a nighttime launch on December 13, 1978. Gaseous hydrogen chloride concentrations and meteorological data, as a function of time after launch, are presented. Hydrogen chloride is present in both the gaseous and aerosol phase in the exhaust cloud. Total HCl concentrations ranged from 18 parts per million by volume (ppm) several minutes after launch down to 1 ppm after the cloud stabilization period, depending on the meteorological conditions. Gaseous HCl concentrations ranged from 2 to 3 ppm several minutes after launch to less than 1 ppm after cloud stabilization. These measured concentrations indicated significant HCl aerosol formation. L.E.M.

N80-28942*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DESIGNING COMMUNITY SURVEYS TO PROVIDE A BASIS FOR NOISE POLICY
James M. Fields Jun. 1980 24 p refs Presented at 99th Acoustical Soc. of Am. Meeting, Atlanta, 21-25 Apr. 1980
(NASA-TM-80110) Avail: NTIS HC A02/MF A01 CSCL 13B

After examining reports from a large number of social surveys, two areas were identified where methodological improvements in the surveys would be especially useful for public policy. The two study areas are: the definition of noise indexes and the assessment of noise impact. Improvements in the designs of surveys are recommended which would increase the validity and reliability of the noise indexes. Changes in interview questions and sample designs are proposed which would enable surveys to provide measures of noise impact which are directly relevant for public policy. Author

N80-28943*# National Aeronautics and Space Administration, Washington, D. C.
DISTURBANCE CAUSED BY AIRCRAFT NOISE
R. Josse Apr. 1980 14 p Transl. into ENGLISH from Cah. du Centre Sci. et Tech. du Batiment (Paris), Rept. 100, Cah. 689, Jun. 1969 p 48-51 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75474) Avail: NTIS HC A02/MF A01 CSCL 13B

Noise pollution caused by the presence of airfields adjacent to residential areas is studied. Noise effects on the sleep of residents near airports and the degree of the residents noise tolerance are evaluated. What aircraft noises are annoying and to what extent the annoyance varies with sound level are discussed. L.F.M.

N80-28944*# National Aeronautics and Space Administration, Washington, D. C.
REACTION OF THE FRENCH POPULATION TO THE SUPERSONIC BANG
J. Bremond May 1980 16 p Transl. into ENGLISH from Rev. Med. Aeronaut. et Spatiale (France), v. 13, no. 51, 1974 p 208-213 Original language document announced as A75-17371 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prepared by French Army Research Div.
(Contract NASw-3199)
(NASA-TM-75487) Avail: NTIS HC A02/MF A01 CSCL 13B

A discussion of a survey dealing with the supersonic bang is presented. Topics include the position the bang has in today's pollution, annoyance caused by the bang and its dependence on sociological and psychological variables, and whether or not the perception of the ban is objective. Other questions raised are whether the frequency of exposure to the bang has an influence on attitudes and does the sensitivity to or annoyance from the bang have a linear increase with the frequency. E.D.K.

N80-28945*# National Aeronautics and Space Administration, Washington, D. C.
THE NUISANCE DUE TO THE NOISE OF AUTOMOBILE TRAFFIC: AN INVESTIGATION IN THE NEIGHBORHOODS OF FREEWAYS
Claude Lamure and Michel Bacalon Apr. 1980 29 p refs Transl. into ENGLISH from Cah. du Centre Sci. et Tech. du Batiment (France), no. 88, Oct. 1967, Cah. 762 p 1-12 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Centre Scientifique et Technique du Batiment, France
(Contract NASw-3198)
(NASA-TM-75812) Avail: NTIS HC A03/MF A01 CSCL 13B

An inquiry was held among 400 people living near freeways in an attempt to determine the characteristics of traffic noise nuisance. A nuisance index was compiled, based on the answers to a questionnaire. Nuisance expressed in these terms was then compared with the noise level measured on the most exposed side of each building. Correlation between the nuisance indexes and the average noise levels is quite good for dwellings with facades parallel to the freeway. At equal noise levels on the most exposed side, the nuisance given for these latter dwellings is lower than for others. Author

N80-28946*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.
ANNOYANCE DUE TO MULTIPLE AIRPLANE NOISE EXPOSURE
Clemans A. Powell Aug. 1980 42 p refs
(NASA-TP-1706; L-13710) Avail: NTIS HC A03/MF A01 CSCL 13B

A laboratory study was conducted to investigate the annoyance effects of multiple aircraft noise exposure in which 250 subjects judged the annoyance of half-hour periods of airplane noise simulative of typical indoor home exposures. The variables of the aircraft noise exposure were the peak noise level of flyovers, which was constant within each period, and the number of flyovers. Each subject judged 5 of the possible 25 factorial combinations of level and number. Other variables investigated included the experience of the test subjects in making annoyance judgments and their home exposure to airplane noise. The annoyance judgments increased with both noise level and number of flyovers. The increased annoyance produced by doubling the number of flyovers was found to be the equivalent of a 4 to 6 db increase in noise level. The sensitivity of the subjects to changes in both noise level and number of flyovers increased with laboratory experience. Although the means of the annoyance judgments made in the laboratory were found to decrease with the subjects' home exposure to aircraft noise, the subjects' sensitivities to changes in both level and number were unaffected by their home exposure. Author

N80-28947# Automation Industries, Inc., Silver Spring, Md. Vitro Labs. Div.
ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK
Dec. 1979 218 p refs
(Contract DE-AC01-79CS-30027)
(SOLAR/0010-79/12) Avail: NTIS HC A10/MF A01

Environmental information collected at each of the sites for the reporting month are tabulated. Data included are insolation, temperature, wind, and relative humidity. These data are for use in determining the thermal performance of the solar systems. (MHR). DOE

N80-28948# Boyce Thompson Inst. for Plant Research Inc., Ithaca, N. Y.
EFFECTS OF SULFUR DIOXIDE AND NITROGEN DIOXIDE ON VEGETATION Progress Report, 1 Apr. - 30 Sep. 1979
L. H. Weinstein, D. C. McCune, D. C. MacLean, J. A. Laurence, R. G. Amundson, Ruth Alscher-Herman, Patrick Hughes, and Allen Renwick Oct. 1979 11 p

(Contracts DE-AS02-77EV-04368; EE-77-S-02-4368)
(DOE/EV-04368/3) Avail: NTIS HC A02/MF A01

Progress in research on the effects of sulfur dioxide and nitrogen dioxide on plants is presented. Specific areas of investigation include: effects of NO2 on the phytotoxicity of SO2; interactions of air pollutants, plants and plant pathogens; effects of SO2 on plant-insect interactions; mode of action and metabolism of SO2 in plants. DOE

N80-28949# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.

IMPACT OF REDUCED VENTILATION ON INDOOR AIR QUALITY IN RESIDENTIAL BUILDINGS

James V. Berk, Craig D. Hollowell, James H. Pepper, and Rodger A. Young Mar. 1980 21 p refs Presented at the Air Pollution Control Assoc. Ann. Meeting, Montreal, Canada, Jun. 1980
(Contract W-7405-eng-48)
(LBL-10527; EEB-Vent-80-5; CONF-800608-2) Avail: NTIS HC A02/MF A01

A research program being conducted to determine the extent to which low ventilation rates are compatible with good indoor air quality is described. Overall indoor, air quality is influenced by air-exchange rates, types of appliances and building materials used, and occupant activities. From the numerous indoor air pollutants studied, four are receiving considerable attention in the context of potential health risks associated with energy conservation. Field monitoring studies in energy efficient residential buildings have demonstrated that in some cases these indoor generated pollutants exceed outdoor air quality standards in houses having air-exchange rates of less than 0.5 air changes per hour. The results of our research suggest that further studies, designed to include a broader range of infiltration rates and occupancy conditions are needed before establishing energy efficient infiltration standards for residential buildings. DOE

N80-28950# California Univ., Berkeley. Lawrence Berkeley Lab. Naval Biosciences Lab.

EFFECTS OF ENERGY CONSERVATION MEASURES ON AIR HYGIENE IN PUBLIC BUILDINGS Final Report

R. L. Dimmick and H. Wolochow Feb. 1980 62 p refs
(Contract W-7405-eng-48)
(LBL-10553; EER-Vent-80-2) Avail: NTIS HC A04/MF A01

Scientific, technical, and material support are provided regarding sampling, assay, and data analysis of the airborne bacterial content of hospitals and educational facilities. The magnitude of change in the numbers of airborne microbes are estimated as a function of ventilation practice. R.C.T.

N80-28951# Centre d'Etudes Phytosociologiques et Ecologiques, Montpellier (France). Dept. d'Ecologie Generale.

A CONTRIBUTION TO THE ECOLOGICAL ANALYSIS OF THE ARID ZONES OF TUNISIA WITH THE HELP OF SPATIAL REMOTE-SENSING DATA: ARZOTU EXPERIMENT Final Report, 1975-1978

Dec. 1978 239 p refs In FRENCH; ENGLISH summary Sponsored by CNES Prepared in cooperation with Institut National de la Recherche Agronomique, Gabes Tunisia and Office de la Recherche Scientifique et Technique Outre-Mer, Yaounde, Cameroon Original contains color illustrations
Avail: NTIS HC A11/MF A01

The processing and thematic interpretation of LANDSAT data acquired during 1972 and 1973 and during the 1975 to 1977 period are discussed. During the last period the investigations were completed with ground observations. Small-scale cartography of ecological zones, land uses, desert conditions as well as large-scale mapping were partially achieved. The usefulness of spatial-temporal data in regional modeling was demonstrated. The results obtained give a comprehensive view of the potential for employing such techniques is the arid zones of the Northern Sahara. Author (ESA)

N80-28952# Institut de Recherche de Transports, Bron (France). Centre d'Evaluation et de Recherches des Nuisances.

POLLUTION BY AIRCRAFT TRAFFIC. POLLUTION FORECAST MODEL IN THE VICINITY OF AIRPORTS. APPLICATION TO VARIOUS AIRPORTS: ORLY AND ROISSY-EN-FRANCE

Jean Delsey, Robert Journard, and Gerard Peri (Societe Comex, Marseille, France) 1979 14 p refs
Avail: NTIS HC A02/MF A01

The differential equation of pollutant turbulent diffusion is numerically resolved for airports after some simplifications. The hypotheses which led to wind and diffusivity formulas are indicated. Data are given for calculating the different parameters, particularly those of aircraft pollutant emissions depending on different types of aircraft. The model is operational for any airport and shows the importance of meteorological factors.
Author (ESA)

N80-28953# Royal Netherlands Meteorological Inst., De Bilt.

NETWORK FOR THE DETERMINATION OF THE CHEMICAL COMPOSITION OF PRECIPITATION IN THE NETHERLANDS: ANNUAL SURVEY, 1978 Annual Report [MEETNET VOOR BEPALING VAN DE CHEMISCHE SAMENSTELLING VAN DE NEERSLAG IN NEDERLAND]

1979 45 p refs In DUTCH; ENGLISH summary Prepared in cooperation with Rijksinstituut voor de Volksgezondheid, Bilthoven, Netherlands
(KNMI-156-1) Avail: NTIS HC A03/MF A01

The 12 stations, which began operating in 1978, test conductivity, pH, and the concentrations of NH4, Na, K, Ca, Mg, F, Cl, NO3 and SO4. The analytical methods are described, and data collected for the year given. Author (ESA)

N80-28954# Environmental Sciences Research Lab., Research Triangle Park, N.C.

SCHEME FOR ESTIMATING DISPERSION PARAMETERS AS A FUNCTION OF RELEASE HEIGHT Progress Report, Jul. 1977 - Jun. 1979

John S. Irwin Oct. 1979 68 p refs
(PB80-169436; EPA-600/4-79-062) Avail: NTIS HC A04/MF A01 CSCL 13B

A generalized scheme is presented for estimating atmospheric pollutant dispersion parameters as a function of release height. The scheme incorporates results from various studies, and once it is more practically structured it will prove useful for characterizing dispersion from tall sources in a variety of situations. The generalized scheme was developed particularly, Gaussian plume modeling; therefore, it is restricted to modeling applications having flat terrain and having steady-state meteorological conditions. GRA

N80-28955# Radian Corp., Austin, Tex.

INVESTIGATION OF NO2/NOx RATIOS IN POINT SOURCE PLUMES Final Report, Dec. 1978 - Dec. 1979

J. P. Blanks, E. P. Hamilton, III, B. R. Epright, and N. A. Nielsen Feb. 1980 74 p refs
(Contract EPA-68-02-2808)
(PB80-169550; EPA-600/7-80-036) Avail: NTIS HC A04/MF A01 CSCL 13B

The relationship of ground level NO2 concentration to NOx emission (NO2/ NOx ratio) in plume for six large power plants in the Chicago area was investigated using a photostationary state reactive Gaussian plume model. The level of NOx control required to meet a probable short term NO2 national ambient air quality standard was assessed. The major uncertainty of a earlier study was its assumption of uniform, fixed NO2/NOx ratios of 0.5 (summer) and 0.25 (winter). The previous study indicated that most of the six plants could meet a 500 microgram/cu m short-term NO2 standard using NOx combustion modification techniques (50% NOx control); this study indicates NOx flue gas treatment technology (90% control) may be required on these plants to meet a 750 microgram/cu m standard, and most certainly for 500 micrograms/cu m. GRA

N80-28956# SRI International Corp., Menlo Park, Calif.

COMPUTER MODELING OF SIMULATED PHOTOCHEMICAL SMOG Final Report, Sep. 1977 - Aug. 1979

D. G. Hendry, A. C. Baldwin, and D. M. Golden Feb. 1980 222 p refs
(Contract EPA-68-02-2427)
(PB80-169675; EPA-600/3-80-029) Avail: NTIS HC A10/MF A01 CSCL 04A

Efforts to develop chemical kinetic mechanisms to describe the formation of photochemical smog are discussed. Detailed mechanisms for the atmospheric reactions of toluene, m-xylene,

propene, ethene, formaldehyde, and acetaldehyde were constructed from available experimental and chemical kinetic data. These mechanisms were used to simulate smog chamber data from air pollution research centers. GRA

N80-28957# Shell Development Co., Houston, Tex.
MULTIMAX: AN AIR DISPERSION MODELING PROGRAM FOR MULTIPLE SOURCES, RECEPTORS, AND CONCENTRATION AVERAGES Final Report
J. H. Moser Aug. 1979 197 p refs
(PB80-170178; NTIS/DF-80/003A) Avail: NTIS HC A09/MF A01 CSCL 04A

A complete update of the computer program MULTIMAX is given. The original computer program was developed on a Univac 1110 computer; a number of machine dependent features of the software were utilized in order to attain maximum flexibility of the program from a user's standpoint. In 1978, the Tennessee Valley Authority modified the Univac 1110 version of MULTIMAX so that it would run on IBM 360/370 computers. The major additions to this user's manual are appendices which discuss input formats for the IBM program version, certain machine dependent features of the programs and show example inputs and outputs for the Univac and the IBM versions. GRA

N80-28958# North Dakota State Dept. of Health, Bismarck. Div. of Environmental Research.
THE LONG-TERM EFFECTS OF TRACE ELEMENTS EMITTED BY ENERGY CONVERSION OF LIGNITE COAL Final Report
Martin R. Schock, William W. Morrison, and Gene A. Christianson Jul. 1979 274 p refs
(Contract OWRC-10773210)
(PB80-168867) Avail: NTIS HC A12/MF A01 CSCL 13B

Results from a two year project, concerning effects of selected elements upon the ecosystem surrounding a 675 megawatt coal fired electrical generating facility are reviewed. The project involved the collection of coal, stack fly ash, aerosol, surface water, snow, sediments, soil, and vegetation samples for analysis of element concentrations. A modified atmospheric transport and deposition computer model was developed and used to predict ground level air concentrations and development of elements from the burning of lignite coal. The results of the project provide evidence of enrichment of certain elements in aerosols, snow, water, soil surface, and vegetation. GRA

N80-28959# Rockwell International Corp., Creve Couer, Mo. Environmental Monitoring and Services Center.
REGIONAL AIR POLLUTION STUDY: GAS CHROMATOGRAPHY LABORATORY OPERATION Final Report
G. Cardwell Jan. 1980 139 p refs
(Contract EPA-68-02-2093)
(PB80-169691; EPA-600/4-80-006) Avail: NTIS HC A07/MF A01 CSCL 07D

A gas chromatography laboratory was set up to analyze air samples collected in Teflon bags and stainless steel tanks. Samples were analyzed for total hydrocarbons, methane, CO, and C2-C10 hydrocarbons. A total of 455 samples, including replicates, were analyzed during the summer and fall of 1976. Many samples were collected at 12 of the Regional Air Monitoring Systems (RAMS) sites to yield data on spatial and temporal distributions of hydrocarbons. Additional sampling was performed to study ethylene contamination in and around RAMS stations. Quality control audits indicated good system performance during the study. Replicate samples indicated good reproducibility for samples stored for as long as six days in the Teflon bags. GRA

N80-28960# North Dakota State Dept. of Health, Bismarck. Div. of Environmental Research.
THE LONG-TERM EFFECTS OF TRACE ELEMENTS EMITTED BY ENERGY CONVERSION OF LIGNITE COAL. VOLUME 2: TECHNICAL APPENDICES Final Report
William W. Morrison, Martin R. Schock, and Gene A. Christianson Jul. 1979 211 p
(Contract OWRC-10773210)
(PB80-168875) Avail: NTIS HC A10/MF A01 CSCL 07D

A two year project concerning effects of selected elements upon the ecosystem surrounding a 675 megawatt coal fired electrical generating facility, was completed. This involved the collection of coal, stack fly ash, aerosol, surface water, snow, sediments, soil, and vegetation samples for analysis of element concentrations. A modified atmospheric transport and deposition computer model was developed and used to predict ground level air concentrations and development of elements from the burning of lignite coal. The results provide evidence of enrichment of certain elements in aerosols, snow, water, soil surface, and vegetation. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N80-28961 Institut d'Aeronomie Spatiale de Belgique, Brussels.
DETECTION OF POSITIVE IONS IN THE STRATOSPHERE Ph.D. Thesis - Ghent Univ. [DETECTIE VAN POSITIEVE IONEN IN DE STRATOSFEER]
D. Nevejans 1979 229 p refs In DUTCH; ENGLISH summary
(Aeronomica-Acta-A-210-1979) Avail: Issuing Activity

A balloon-borne mass spectrometer experiment for the detection of ions in the stratosphere D-region was performed. The vacuum apparatus, mass filter, ion detection and mass selection systems are described. The stratospheric ion population was simulated for calibration. At 35 km (5.1 mbar), the natural ions could be classified into at least two groups of hydrates. One group can be related with high probability to the proposed proton hydrates, while a second series seem to be hydrates of an unknown ion with a mass of 41 A.M.V. Author (ESA)

N80-28962*# Denver Univ., Colo. Dept. of Physics.
STUDIES OF THE EARTH-LIMB ABSORPTIONS IN THE NEAR ULTRAVIOLET Final Report
David G. Murcray Apr. 1980 7 p
(Grant NsG-1557)
(NASA-CR-163370) Avail: NTIS HC A02/MF A01 CSCL 04A

The use of solar occultation techniques as a means of obtaining data on the photochemistry of the ozone layer was investigated. A spectrometer equipped with a photomultiplier detector and associated electronics necessary to amplify the output of the detector up to a level suitable for on-board recording and also for telemetering to the ground, was packaged with a solar telescope and flown by balloon in order to obtain solar spectra in the region between 3080 A and 3100 A with a resolution of close to 0.05 A. Data reduction techniques required to remove solar OH lines from atmospheric OH line spectra are described as well as the instrument package. A.R.H.

N80-28963*# General Electric Co., Philadelphia, Pa. Space Div.
ATMOSPHERIC LIDAR MULTI-USER INSTRUMENT SYSTEM DEFINITION STUDY Final Report
R. V. Greco, ed. Washington, D.C. NASA Aug. 1980 343 p refs
(Contract NAS1-15476)
(NASA-CR-3303) Avail: NTIS HC A15/MF A01 CSCL 04A

A spaceborne lidar system for atmospheric studies was defined. The primary input was the Science Objectives Experiment Description and Evolutionary Flow Document. The first task of the study was to perform an experiment evolutionary analysis of the SEED. The second task was the system definition effort of the instrument system. The third task was the generation of a program plan for the hardware phase. The fourth task was the supporting studies which included a Shuttle deficiency analysis, a preliminary safety hazard analysis, the identification of long lead items, and development studies required. As a result of the study an evolutionary Lidar Multi-User Instrument System (MUIS) was defined. The MUIS occupies a full Spacelab pallet and has a weight of 1300 kg. The Lidar MUIS laser provides a 2 joule frequency doubled Nd:YAG laser that can also pump a tuneable dye laser wide frequency range and bandwidth. The

MUIS includes a 1.25 meter diameter aperture Cassegrain receiver, with a moveable secondary mirror to provide precise alignment with the laser. The receiver can transmit the return signal to three single and multiple photomultiple tube detectors by use of a rotating fold mirror. It is concluded that the Lidar MUIS proceed to program implementation. L.F.M.

N80-28964# Magnetic Observatory, Hermanus (South Africa).
MAGNETIC OBSERVATIONS AT SANAE 1977 - 1978
1979 95 p
(CSIR-MAG-B19; ISBN-0-7988-1631-7) Avail: NTIS HC A05/MF A01

The variations of the magnetic elements declination, horizontal intensity, and vertical intensity were recorded by a magnetometer consisting of a set of La Cour variometers, incorporated into an electronic feedback system which was designed to hold the reflected light beams from the variometers in fixed positions on three separate photocells. The value of the compensating magnetic field needed to hold each light beam in a fixed position was recorded by a digital meter. The output of the system was recorded digitally on punched paper tape, System 1, and in analogue form on a strip chart, System 2. The data presented are those obtained from the System 1 digital output, supplemented where necessary from the System 2 strip chart. E.D.K.

N80-28965*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Space Sciences Lab., Science and Engineering.
NASA/MSFC FY-80 ATMOSPHERIC PROCESSES RESEARCH REVIEW
Robert E. Turner, comp. Jun. 1980 167 p refs Review held at Huntsville, Ala., 3-5 Jun. 1980
(NASA-CP-2145) Avail: NTIS HC A08/MF A01 CSCL 04A

Three general areas of research were discussed: Global Weather, Upper Atmosphere, and Severe Storms and Local Weather. Research project summaries, in narrative outline form, stating objectives, significant accomplishments, and recommendations for future research are presented. L.F.M.

N80-28966# Science Applications, Inc., La Jolla, Calif.
ROSCOE MANULA, VOLUME 14C: FURTHER DENSITY PROFILES OF SELECTED ATMOSPHERIC SPECIES Final Report, 1 Jan. 1976 - 30 Jun. 1979
Benjamin F. Myers 30 Jun. 1979 120 p refs
(Contract DNA001-76-C-0194)
(AD-A084640; AD-E300760; SAI-78-604-LJ-2B-Vol-14C; DNA-3964F-14C-Vol-14C) Avail: NTIS HC A06/MF A01 CSCL 04/1

Profiles and models of ambient atmospheric species are presented for water, ozone, methane, carbon monoxide, hydroxyl and hydroperoxyl radicals, hydrogen atoms, nitrous and nitric oxides, nitrogen atoms (N and N(2D)), and excited atomic oxygen (O(1D)). This report greatly extends and partly revises volume 14b which pertained only to midlatitude density profiles of H2O, O3, CO2, NO2, NO, N, O, and O2(a1 delta G). GRA

N80-28967# Ohio State Univ., Columbus. Dept. of Geodetic Science.
CONCEPTS IN GEODETIC REFERENCE FRAMES Interim Report
Helmut Moritz Hanscom AFB, Mass. AFGL Oct. 1979 65 p refs
(Contract F19628-79-C-0075; AF Proj. 7600)
(AD-A084099; DGS-294; SCIENTIFIC-2) Avail: NTIS HC A04/MF A01 CSCL 08/5

The report reviews conceptual aspects and problems arising in a precise definition of reference frames for the purpose of geodesy and geodynamics. The concepts: physical, conventional, and average system are introduced. Inertial systems are discussed from the point of view of classical mechanics and of the theory of relativity. The concept of celestial pole, which plays a fundamental role in a precise definition of precession, nutation and polar motion, is reviewed in some detail. A section is devoted to tidal effects, which should be removed from the coordinates. Finally, various definitions of terrestrial reference systems are compared. GRA

N80-28968# Naval Research Lab., Washington, D. C.
RECENT COMPUTATIONAL STUDIES OF THE EQUATORIAL ELECTROJET Interim Report
M. J. Keskinen 24 Mar. 1980 21 p refs Presented at Cornell-NASA Workshop on the Equatorial Ionosphere, Ithaca, N.Y., 22-23 Oct. 1979
(RR0330244)
(AD-A084554; AD-E000404; NRL-MR-4195) Avail: NTIS HC A02/MF A01 CSCL 04/1

A brief review of recent computational studies of the E-region equatorial electrojet is presented. Agreement and discrepancies between numerical simulation studies and both theory and experiment are given. Some outstanding problems are identified and new experiments suggested. GRA

N80-28969# Lowell Univ., Mass.
AUTOMATIC IONOSPHERIC PARAMETER EXTRACTION FROM DIGITAL IONOGRAM DATA Interim Report
S. Smith, B. W. Reinisch, J. S. Tang, and K. Bibl Hanscom AFB, Mass. AFGL Nov. 1979 86 p refs
(Contract F19628-78-C-0085; AF Proj. 4643)
(AD-A084101; ULRF-404/CAR; SCIENTIFIC-1; AFGL-TR-80-0102) Avail: NTIS HC A04/MF A01 CSCL 04/1

The development of techniques to automatically extract the ionospheric ionization parameters of foF2, M(3000), fmin, and ftEs from digital ionograms have become feasible with the advent of advanced digital sounders. From digital ionogram data of the Digisonde 128PS the six most significant echoes for each frequency are extracted in the Geomonitor. They are further processed in the Automatic Parameter Evaluation program (A.P.E.) to determine the main echo height for each frequency. The program takes into consideration the frequency continuity of the reflection height, multiple hop reflection heights, rate of change of slope and the physical properties of the ionogram such as foE's dependence on the solar zenith angle. The output data are mathematically smoothed to produce a refined ionogram. From this refined ionogram the A.P.E. program determines the four ionospheric parameters. In a study of 1500 ionograms the automatically evaluated ionogram parameters are compared with the manually scaled values and the differences are analyzed statistically. Also some case studies are discussed concentrating on the reasons for larger deviations. The program has been written considering the future possibility of implementation in a microcomputer which can integrate the functions of the Geomonitor, as well as a True Height Analysis program. GRA

N80-28970# Lowell Univ., Mass. Center for Atmospheric Research.
NEAR AND FAR WING PRESSURE BROADENING THEORY FOR APPLICATION TO ATMOSPHERIC ABSORPTION Final Report, Oct. 1976 - Nov. 1979
R. W. Davies, R. R. Gamache, and B. A. Oli Feb. 1980 65 p refs
(Contract F19628-77-C-0053; AF Proj. 2310)
(AD-A084116; ULRF-406/CAR; AFGL-TR-80-0062) Avail: NTIS HC A04/MF A01 CSCL 04/1

A new theory of far wing pressure broadening is presented. The theory rigorously satisfies the Fluctuation-Dissipation Theorem, and includes all possible line coupling effects. The starting point of the theory rests on the observation that far wings are determined by the binary collision approximation in its most naive form. The theory is then developed in terms of two-body T-matrix of scattering theory. Results of near wing calculations of halfwidths and pressure shifts for H2O-N2 and H2O-H2O are briefly summarized. GRA

N80-28971# Germantown Labs., Inc., Philadelphia, Pa.
CHEMICAL RELEASE PAYLOADS: STRATOSPHERIC WIND MEASUREMENT Final Report, 15 Jan. 1979 - 31 Jan. 1980
Charles S. Stokes, William J. Murphy, and Alan D. Kershner 31 Jan. 1980 21 p
(Contract F19628-79-C-0057; AF Proj. 6687)
(AD-A084100; AFGL-TR-80-0073) Avail: NTIS HC A02/MF A01 CSCL 22/2

This report covers work performed on a series of chemical payload launches on sounding rockets, which were launched from

Punto Lobos, Peru during October, 1979. These operations included design, fabrication, assembly and launch services for chemical payloads containing trimethyl aluminum (TMA) or titanium tetrachloride (TiCl4) - methanol/water. GRA

N80-28972# BDM Corp., Monterey, Calif.
AN AIRCRAFT STUDY OF TURBULENCE DISSIPATION AND TEMPERATURE STRUCTURE FUNCTION IN THE UNSTABLE MARINE ATMOSPHERIC SURFACE LAYER
C. W. Fairall (Naval Postgraduate School) 17 Mar. 1980 34 p refs
(Contract N00014-78-C-0204)
(AD-A084387; BDM/M-004-80) Avail: NTIS HC A03/MF A01 CSCL 04/1

The dissipation rate of turbulent kinetic energy, sigma, and the temperature structure function parameter, C sub T squared, were measured over water from the near surface (Z = 3m) to the top of the boundary layer. The near surface values of sigma and C sub T squared were used to calculate the velocity and temperature Monin-Obukhov scaling parameters. The unstable data were used to evaluate the feasibility of extrapolating the values of sigma and C sub T squared as a function of height with empirical scaling formulae. The dissipation rate scaling formula of Wyngaard et al. (1971a) gave a very good fit to an average of the sigma data for Z - Z sub i - 100. Although the C sub T squared data obeyed a (cube root of Z to the 4th power) height dependence for 0.1 Z sub i - Z - 0.5 Z sub i, the scaling formula of Wyngaard et al. (1971b) disagreed with the average C sub T squared by as much as 50%. At this point it is not clear if the discrepancy is a unique property of the marine boundary layer or if it is simply some unknown instrumental or analytic property. GRA

N80-28973# Air Force Geophysics Lab., Hanscom AFB, Mass. Optical Physics Div.
ATMOSPHERIC ATTENUATION OF MILLIMETER AND SUBMILLIMETER WAVES: MODELS AND COMPUTER CODE Environmental Research Papers. Interim Report
Vincent J. Falcone, Jr., Leonard W. Abreu, and Eric P. Shettle 15 Oct. 1979 75 p refs
(AF Proj. 7679)
(AD-A084485; AFGL-TR-79-0253; AFGL-ERP-679) Avail: NTIS HC A04/MF A01 CSCL 04/1

Atmospheric attenuation of millimeter and submillimeter waves is calculated for clear, fog, cloud and rain atmospheres. The frequency range considered is 1-1000 GHz. The clear atmospheres transmission spectra is calculated by a computer efficient algorithm of AFGL's HITRAN code. This new code is called FASCODE-1. The hydrometeor attenuation of fog, clouds and rain (precipitation), calculated by Mie scattering is addend to FASCODE-1. Models of fog, clouds and rain typical of mid-latitude temperate regions are used in calculations of transmission and attenuation. GRA

N80-28974# Air Force Geophysics Lab., Hanscom AFB, Mass. Meteorology Div.
NUMERICAL STUDIES ON A GLOBAL BAROTROPIC VORTICITY EQUATION MODEL OF THE ATMOSPHERE Final Report
Samuel Y. K. Yee and Ralph Shapiro 12 Dec. 1979 33 p refs
(AF Proj. 2310)
(AD-A084487; AFGL-TR-79-0295; AFGL-ERP-686) Avail: NTIS HC A03/MF A01 CSCL 04/1

Numerical experiments have been designed to study the suitability of certain numerical methods commonly used in the numerical modeling of the atmosphere. Specifically, we conducted experiments to address the following: (1) What effect does a Shapiro-type filter have on the results of a numerical time-integration? (2) What are the capabilities and limitations of numerical approximations such as second-order finite-difference approximations in numerical time-integrations? The Shapiro filter is found to be very effective in the removal of computation noise and is therefore useful for insuring computational stability in a long-term time-integration. For dynamically stable flows, numerical errors due to truncation and round-off are amplified by the dynamics of the stable system. Numerical methods such as second order finite-difference approximations, together with a Shapiro-type filter, are adequate in yielding approximate solutions to the modeling differential equations. For dynamically unstable flows, numerical errors are amplified as part of the dynamics of the unstable system. The use of finite-difference approximations may yield solutions which bear no resemblance whatsoever to the true solution of the differential equations. It is postulated that interactions among long wave computational modes and physical modes in a numerical model may prove to be another major obstacle in the numerical prediction of an unstable flow. GRA

N80-28975# Air Force Geophysics Lab., Hanscom AFB, Mass.
AN ALGORITHM FOR DETERMINING THE BOUNDARY OF AURORAL PRECIPITATION USING DATA FROM THE SSJ/3 SENSORS Environmental Research Paper
David A. Hardy and Richard MacKeen 24 Jan. 1980 41 p refs
(AF Proj. 7601)
(AD-A084482; AFGL-TR-80-0028; AFGL-ERP-693) Avail: NTIS HC A03/MF A01 CSCL 04/1

In support of the Global Weather Central of the Air Weather Service, computer techniques were developed to determine, in near real time, the equatorward boundary of the auroral oval using the data from the SSJ/3 sensors flown on board the DMSP satellites. The boundary is determined on both the morning and evening sides of the oval and in both northern and southern auroral zones. Three tests are used in the boundary determination, one on the evening side and two on the morning side of the auroral oval. On the evening side of the auroral zone, since low energy particles always are observed at the lowest latitude, the boundary is determined by testing the summed counts in the six channels of the SSJ/3 detector convering the energy range from 110 e V to 1000 e V. The boundary is chosen when the summed counts exceed 30 for 3 successive seconds. The data are always tested as a function of increasing magnetic latitude. On the morning side, high energy electrons are always observed first. Since the channels measuring high energy electrons may be contaminated by penetrating particles from the ring belts, two tests are required. E.D.K.

N80-28976# Air Force Geophysics Lab., Hanscom AFB, Mass.
ARCHIVE DATA TAPES OF THE AFGL MAGNETOMETER NETWORK
David J. Knecht 20 Sep. 1979 26 p ref
(AF Proj. 7601)
(AD-A084483; AFGL-TR-79-0212; AFGL-SR-224) Avail: NTIS HC A03/MF A01 CSCL 08/14

All data returned by the data-collection stations of the AFGL magnetometer network are recorded automatically on a series of magnetic tapes referred to as the Archive tapes. On these tapes, data are reordered, to effect grouping by instrument and compressed, to minimize the amount of tape used, but are otherwise in raw form and unedited. This report describes the format and content of these tapes with sufficient precision and detail that a prospective user can, if necessary, access the data without further guidance or instruction. Conversion factors and decoding schemes are specified to permit conversion of the data to the usual physical units. Comments and suggestions are included to facilitate subsequent cleaning and editing processes. GRA

N80-28977# Aerospace Corp., El Segundo, Calif. Guidance and Control Div.
SINGLE-LAYER REFRACTION CORRECTION MODEL Final Report
D. W. Whitcombe 15 Nov. 1979 49 p refs
(Contract F04701-79-C-0080)
(AD-A084634; TR-0080(5450-01)-1; SD-TR-80-19) Avail: NTIS HC A03/MF A01 CSCL 17/9

A single layer tropospheric refraction model is developed for use in real time with C-band and X-band radars when tracking satellites or powered rocket vehicles above the troposphere (approx. 25 km). Corrections for range and elevation angle are provided that are usable for all elevation angles above the horizon. GRA

N80-28978# Science Applications, Inc., La Jolla, Calif.
ROSCOE MANUAL, VOLUME 14A-1, AMBIENT AT-

MOSPHERE. MAJOR AND MINOR NEUTRAL SPECIES AND IONOSPHERE Final Report, 1 Jan. 1976 - 30 Jun. 1979
Daniel A. Hamlin and Melvin R. Schoonover 30 Jun. 1979 221 p
(Contract DNA001-76-C-0194)
(AD-A084993; AD-E300781; SAI-78-604-LJ; DNA-396F-1A-4) Avail: NTIS HC A10/MF A01 CSCL 04/1

The ROSCOE-Radar ambient atmosphere model has been extensively revised to provide (a) major atmospheric properties and species densities corresponding to either a code-generated or (optional) user-specified latitude- and season-dependent temperature profile below 120-km altitude, (b) an increase from 10 to 19 minor species profiles (O, O(1d), (a1 triangle g), O sub 3, N(4S), N2D), N(2P), NO, NO sub 2, N sub 2 O, CO sub 2, CO, CH sub 4, H sub 2 O, H, AR, and HE), with some of them having complex dependencies on latitude (or even geographic position in the case of water below 5-km altitude), local apparent time, fractional season-year, and solar decimetric flux, (c) (optional) user-specified water-vapor profile, and (d) an ionosphere with e, O-, NO-, O-2, and N-2 as ionized species (more than 90 km). GRA

N80-28979# Boston Univ., Mass. Dept. of Astronomy.
SHORT TERM PERIODICITIES IN IONOSPHERIC TOTAL ELECTRON CONTENT Annual Scientific Report, 1 Oct. 1978 - 30 Sep. 1979
Kenneth H. Schatten and Michael Mendillo AFGL Hnnscom AFB, Mass. Mar. 1980 53 p refs
(Contract E19628-77-C-0270; AF Proj. 4643)
(AD-A084756; ACBU-SER-III-13; AR-2; AFGL-TR-80-0096) Avail: NTIS HC A04/MF A01 CSCL 04/1

Short-term variability of the ionospheric F-region has been studied using total electron content (TEC) data from several North American sites. Specific attention was given to lunar-induced periodicities in TEC and to a general treatment of changes in TEC associated with variations in the height of the F-region (hmF2). In both cases, simple analytical expressions were derived from statistical analysis of the large TEC and hmF2 data bases. These relations are appropriate for updates to model predictions of average conditions during daytime hours. A study of the 'geomagnetic ordering' of TEC variability showed that real-time predictive methods can reduce up to 50% of the normal variability. A preliminary analysis of solar wind sector boundary effects suggested that sector components may order some F-region variability, though the specific relations between these effects and the geomagnetic ordering results remain to be clarified. GRA

N80-28980# Naval Research Lab., Washington, D. C.
NUMERICAL EXPERIMENTS ON THE STRATOSPHERIC-TROPOSPHERIC DYNAMICAL INTERACTION Interim Report
Winston C. Chao (Sci. Appl., Inc., McLean, Va.), Mark R. Schoeberl, and Darrell F. Strobel 11 Apr. 1980 21 p refs
(ZF52551001)
(AD-A084985; AD-E000419; NRL-MR-4209) Avail: NTIS HC A02/MF A01 CSCL 04/2

Numerical experiments with the UCLA-NEPRF tropospheric weather forecast model were performed to test the influence of stratospheric conditions which are representative of sudden warmings on tropospheric weather. Stratospheric conditions were represented by imposed vertical velocities at the upper boundary. An externally forced stratospheric disturbance as large as a sudden warming was found to generate an observable response in sea level pressure with a time constant of the order of a day. The numerical results are interpreted with the aid of an analytical model based on the linearized shallow water equation. GRA

N80-28981# Air Force Geophysics Lab., Hanscom AFB, Mass. Aeronomy Div.
TROPOSPHERIC STRATOSPHERIC TURBULENCE AND VERTICAL DIFFUSIVITIES Final Environmental Research Paper
S. P. Zimmerman and E. A. Murphy 14 Jan. 1980 20 p refs
(AF Proj. 6690)
(AD-A084809; AFGL-TR-80-0020; AFGL-ERP-691) Avail: NTIS HC A02/MF A01 CSCL 04/1

The determination of winds and temperature by rawinsonde allows us to calculate the Richardson number, a measure of atmospheric instability. From this, we can then determine the turbulent atmospheric parameters, diffusivity (K), rate of heat deposition (epsilon), and the vertical turbulent intensity (-w2-). Comparison of these data, for the spring periods, with contours of residual stratospheric radioactivity demonstrate that, at the tropopause, the isocountours of turbulent diffusivity accurately follow the isodensity contours of the residual radioactivity. We also demonstrate that the rapid cessation of the turbulent diffusivity accurately predicts the level of the tropopause. GRA

N80-28982# Edgerton, Germeshausen and Grier, Inc., Los Alamos, N. Mex.
PLASMA BOUNDARY LAYER AND MAGNETOPAUSE LAYER OF THE EARTH'S MAGNETOSPHERE
Timothy Eric Eastman Jun. 1979 264 p refs
(Contract W-7405-eng-36)
(LA-7842-T) Avail: NTIS HC A12/MF A01

Explorer 43 satellite observations of the plasma boundary layer (PBL) and magnetopause layer (MPL) of the Earth's magnetosphere indicate that plasma in the low latitude portion of the PBL is supplied primarily by direct transport of magneto-sheath plasma across the MPL. This transport process is relatively widespread over the entire sunward magnetospheric boundary. DOE

N80-28983# Hawaii Univ., Honolulu. Dept. of Meteorology.
PROJECT AHUPUA'A: SOLAR METEOROLOGICAL FIELD MEASUREMENTS ON THE ISLAND OF HAWAII, SUMMER 1978. 3: TRADE WIND INTERACTIONS WITH LOCAL WINDS IN SOUTH KOHALA
Thomas A. Schroeder Feb. 1980 68 p refs
(Contract DE-AC03-79ET-20184)
(UHMET-79-05) Avail: NTIS HC A04/MF A01

Instrumented vans monitored meteorological elements related to solar energy in the leeward South Kohala district of the Island of Hawaii between 23 and 28 June 1978. This phase of Project Ahupua'a concentrated on sea breeze circulations and their interactions with synoptic scale winds. Supplementary data were collected as in previous phases. In addition, visual observations were made from Anaehoomalu Beach and from an automobile traversing the transect. Daily weather conditions were documented by ground-based photography. The study period was characterized by abnormally high tropospheric moisture content and passage of significant tradewind disturbances. Local weather variability was greater than in earlier phases of project Ahupua'a. Sea breeze intrusion was frequent below 300 m MSL, but occurred at higher elevations only in response to significant synoptic systems. Diurnal variations of measured parameters were strong and reflected diminished sea breeze influence above 300 m. Heating of lava surfaces drives local circulations through two opposing physical processes. Surface pressure gradients support sea breeze development while vertical transport of horizontal (trade wind) momentum creates intense downslope flows. DOE

N80-28984# Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Orleans (France).
ELECTRODYNAMICS OF ATMOSPHERES [ELECTRODYNAMIQUE DES ATMOSPHERES]
M. Blanc, ed. and R. Gendrin, ed. May 1978 186 p refs In FRENCH Presented at Colloq. d'Electrodyn. des Atmospheres, Londe-les-Maures, France, 23-26 May 1977
(CRPE-NT-57) Avail: NTIS HC A09/MF A01

The following topics are presented: general elements of electrodynamics, neutral magnetic layers, convection in the dipole domain of the terrestrial magnetosphere, specific problems related to the magnetosphere of Jupiter, convection in mean latitudes (the atmospheric dynamo), electrojets, and abnormal behavior of plasma in the atmospheric circuit. Author (ESA)

N80-28985# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
INFLUENCE OF DIFFUSE SOLAR RADIATION ON STRATOSPHERIC CHEMISTRY
G. Fiocco (Rome Univ.) Nov. 1979 34 p refs Presented at Ozone Adv. Study Inst. Aldeia das Acoteias, Faro, Portugal, 2-12 Nov. 1979 Sponsored by CNR and Comm. of European Communities

(LPS-79-14) Avail: NTIS HC A03/MF A01

The diffuse effects of the component of solar radiation on stratospheric structure and composition because of photodissociation and heating are considered. The basic relevant aspects of radiative transfer theory are introduced. Recent analyses and calculations concerning the photodissociation and heating rates, which include the effects of the diffuse field, and their application to atmospheric models are reviewed. The results indicate that molecular multiple scattering should always be included in photodissociation calculations if accuracies of the order of a few percent are desired. The variable part of the diffuse field due to surface albedo, clouds, and aerosols can be responsible for large fluctuations in the thermal structure and composition of the stratosphere. Author (ESA)

N80-28986# Royal Netherlands Meteorological Inst., De Bilt.
SEISMOLOGICAL BULLETIN OF THE SEISMOGRAPH STATIONS IN THE NETHERLANDS, VOLUME 61, 1973
1979 119 p
(KNMI-108-61) Avail: NTIS HC A06/MF A01

The instruments, with their operating environment and characteristics, in use at the three stations are described, and seismological data presented for all events measured during 1973. The character of the daily microseismic activity is shown.
Author (ESA)

N80-28987# Royal Netherlands Meteorological Inst., De Bilt.
SEISMOLOGICAL BULLETIN OF THE SEISMOGRAPH STATIONS IN THE NETHERLANDS, VOLUME 62, 1974
1979 109 p
(KNMI-108-62) Avail: NTIS HC A06/MF A01

The instruments, with their operating environment and characteristics, in use at the three stations are described, and seismological data presented for all events measured during 1974. The character of the daily microseismic activity is shown.
Author (ESA)

N80-28988# Oulu Univ. (Finland). Dept. of Physics.
OBSERVATIONS OF JOULE AND PARTICLE HEATING AND FIELD-ALIGNED ION VELOCITY IN THE HIGH-LATITUDE IONOSPHERE
T. Nygren and L. Jalonen Nov. 1978 27 p refs Sponsored in part by Finnish Academy of Science
(Rept-67/1978; ISBN-951-42-0657-6; ISSN-0356-1852) Avail: NTIS HC A03/MF A01

Simultaneous measurements of Joule and particle heating and field aligned ion velocities carried out using the Chatanika (L = 5.6) incoherent scatter radar are presented. Joule heating bursts of 5 - 10 mW/sq m were found to occur throughout the afternoon and night hours. Precipitation heating rates of 2 - 7 mW/sq m were observed in the postmidnight sector. Mostly positive (antiparallel to the geomagnetic field ion velocities were seen in the F region, reaching maximum values of 50 - 75 m/s after local midnight. On one occasion negative daytime velocities were observed during a period of low F region electron density. The possible mechanisms maintaining the measured ion velocities are discussed. Author (ESA)

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-28989 Royal Netherlands Meteorological Inst., De Bilt. Centrale Weerdienst.
EXAMPLES OF THE PRACTICAL USE OF CROSS-SECTIONS [ENKELE VOORBEELDEN VAN PRAKTISCH GEBRUIK VAN DWARSDOORSNEDEN]
J. Vinke 1979 39 p refs In DUTCH
(KNMI-V-332) Avail: NTIS HC A03

The use of potential wet bulb temperatures for frontal analysis and the use of cross sections in operational forecasting are discussed. Examples of weather situations are given to show correlations between 850 mb wet bulb temperatures and cross sections with synoptic surface charts, the 500 mb flow, and satellite photographs. Author (ESA)

N80-28990*# Oregon State Univ., Corvallis. Climatic Research Inst.
ESTIMATING MONTHLY-AVERAGED AIR-SEA TRANSFERS OF HEAT AND MOMENTUM USING THE BULK AERODYNAMIC METHOD
Steven K. Esbensen and Richard W. Reynolds Jul. 1980 35 p refs
(Grants NsG-5308; NSF ATM-77-26406)
(NASA-CR-163045) Avail: NTIS HC A03/MF A01 CSCL 04B

Air-sea transfers of sensible heat, latent heat, and momentum are computed from twenty-five years of middle-latitude and subtropical ocean weather ship data in the North Atlantic and North Pacific using the bulk aerodynamic method. The results show that monthly-averaged wind speeds, temperatures, and humidities can be used to estimate the monthly-averaged sensible and latent heat fluxes computed from the bulk aerodynamic equations to within a relative error of approximately 10%. The estimate of monthly-averaged wind stress under the assumption of neutral stability are shown to be within approximately 5% of the monthly-averaged non-neutral values. Author

N80-28991*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A PRELIMINARY LOOK AT AVE-SESAME 3 CONDUCTED ON 25-26 APRIL 1979
Steven F. Williams (Texas A and M Univ.), Nicholas Horvath (Texas A and M Univ.), and Robert E. Turner Jun. 1980 50 p ref
(NASA-TM-78282) Avail: NTIS HC A03/MF A01 CSCL 04B

General weather conditions, including synoptic maps, radar reports, satellite photographs, precipitation areas and amounts, and a summary of severe weather reports are presented. These data provide researchers a preliminary look at conditions during the AVE-SESAME 3 period. L.F.M.

N80-28992*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
TROPICAL CYCLONE INTENSITIES FROM SATELLITE MICROWAVE DATA Final Annual Report, 1 Apr. 1979 - 31 Mar. 1980
Thomas H. VonderHaar and Stanley Q. Kidder (Illinois Univ., Urbana) Jul. 1980 114 p refs
(Grant NsG-5258)
(NASA-CR-163390) Avail: NTIS HC A06/MF A01 CSCL 04B

Radial profiles of mean 1000 mb to 250 mb temperature from the Nimbus 6 scanning microwave spectrometer (SCAMS) were constructed around eight intensifying tropical storms in the western Pacific. Seven storms showed distinct inward temperature gradients required for intensification; the eighth displayed no inward gradient and was decaying 24 hours later. The possibility that satellite data might be used to forecast tropical cyclone turning motion was investigated using estimates obtained from Nimbus 6 SCAMS data tapes of the mean 1000 mb to 250 mb temperature field around eleven tropical storms in 1975. Analysis of these data show that for turning storms, in all but one case, the turn was signaled 24 hours in advance by a significant temperature gradient perpendicular to the storm's path, at a distance of 9 deg to 13 deg in front of the storm. A thresholding technique was applied to the North Central U.S. during the summer to estimate precipitation frequency. Good agreement was found between gage measurements and satellite estimates, except in Minnesota where a large number of lakes probably biased the estimates. A.R.H.

N80-28993# Oregon State Univ., Corvallis. Dept. of Atmospheric Sciences.
WIND FLOW NEAR THE SURFACE OVER NONUNIFORM TERRAIN Final Report, Nov. 1972 - May 1980
Ernest W. Peterson 9 May 1980 14 p refs
(Grants DAHC04-74-G-0038; DAAG29-77-G-0043)
(AD-A084711; ARO-11797.1-EN; ARO-14440.9-GS) Avail: NTIS HC A02/MF A01 CSCL 04/2

The OSU/Riso Project is an ongoing study of air flow near the ground over complex terrain. The study combines field observations, data analysis, and theoretical modelling in order to assess and understand the effects of terrain features on the mean flow and turbulence structure in the lower portion of the planetary boundary layer. The method of approach is to choose sites with horizontal scales of less than several hundred meters which have a distinctive inhomogeneity but whose boundary conditions are otherwise relatively simple so that there is some hope of constructing theoretical models, to instrument the site as fully as possible to measure the relevant details of the flow, to conduct observations over a long enough period of time to obtain a clear record of the characteristics of the flow, and then to analyze the accumulated data, reconcile the observations with our theoretical constructs, and finally to improve the theory. GRA

N80-28994# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
DIGITAL IMAGING RESEARCH FOR METEOROLOGICAL APPLICATIONS Final Report, 1 Sep. 1976 - 31 Jul. 1979
Thomas A. Brubaker, Thomas H. VonderHaar, Gregory C. Smith, and Marvin Brown 22 Feb. 1980 182 p refs
(Grant DAAG29-76-G-0324)
(AD-A084366; ARO-13971.7-GS) Avail: NTIS HC A09/MF A01 CSCL 05/8

Planning for this joint research on digital imaging by electrical engineers and atmospheric scientists began in early 1976. At that time the use of digital solid state memory under small computer control to refresh a CRT to produce a 'digital image' was in its infancy. Our research focused on the design, procurement, test, demonstration and meteorological research use of the new system. It was very successful and has received national and international acclaim. Several papers were published under sponsorship of this grant and are listed in an Appendix. This Final Report includes complete details of the research on both hardware and software aspects of the system. This research has already lead to the design and research use of the next generation of digital imaging systems. GRA

N80-28995# Army Electronics Research and Development Command, White Sands Missile Range, N. Mex.
PRECIPITATION ESTIMATION FOR MILITARY HYDROLOGY
Bruce T. Miers Apr. 1980 31 p refs
(DA Proj. 1L1-61102-B-53A)
(AD-A085192; ERADCOM/ASL-TR0054) Avail: NTIS HC A03/MF A01 CSCL 04/2

The military hydrologist has been given the responsibility for river stage and flood forecasting, soil trafficability, and weather observations pertinent to hydrologic problems in the battlefield area forward of Division command elements. In tactical situations, the emplacement and monitoring of gages or sensors in hostile territory are not practical; therefore, the military hydrologist must rely on indirect means of estimating precipitation. This report reviews current methods of estimating precipitation (models, radar, satellite) and presents six case studies of precipitation estimation using geostationary operational environmental satellite imagery. It is concluded that the military hydrologist (in the 1980's) can best meet his requirements through the use of calibrated weather radar. GRA

N80-28996# Oregon State Univ., Corvallis. Dept. of Atmospheric Science.
VEGETATION AS AN INDICATOR OF HIGH WIND VELOCITY Final Report, 15 Jun. 1978 - 14 Jun. 1979
E. Wendell Hewson, John E. Wade, and Robert W. Baker Jun. 1979 50 p refs
(Contract EY-76-F-06-2227)
(RLO-2227-T24-79/1) Avail: NTIS HC A03/MF A01

Techniques for using two widely distributed species of coniferous trees, Douglas fir and Ponderosa pine, as aids in wind power prospecting are described. The need for the research, the effects of wind on trees, development of the indices of wind deformation and calibration of these indices to the mean annual wind speed are discussed. Results indicate trees can be used to estimate mean annual wind speed and these estimates, although subject to some uncertainty, are sufficiently sensitive to be used as an initial criterion for ranking potential sites in terms of wind power potential prior to instrumention with anemometers. DOE

N80-28997# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: THE PLAN AND IMPLEMENTATION PROGRAMME, 1980 TO 1983
Jul. 1979 55 p Presented at 8th WMO Congr., Geneva, Apr. - May 1979 and 31st WMO Executive Comm., Geneva, May - Jun. 1979
(WMO-535; ISBN-92-63-10535-9) Avail: NTIS HC A04/MF A01

The plan and the various supporting resolutions of the 8th World Meteorological Congress are presented. The basic purpose of the global observing system has been reviewed and clarified, and the part of the plan dealing with the global data processing system, and global telecommunication system are updated. Two additional parts of the plan include the monitoring scheme of the operation of the world weather watch, and guidance on priorities for furthering the world weather watch. Author (ESA)

N80-28998# Royal Netherlands Meteorological Inst., De Bilt.
YEARBOOK A: METEOROLOGY, VOLUME 130 Annual Report, 1978
1979 73 p refs In DUTCH and ENGLISH
(KNMI-97-130) Avail: NTIS HC A04/MF A01

Daily observations and summaries of monthly and yearly data taken at 45 meteorological stations in the Netherlands during 1978 are presented. The location and elevation of each station and the instruments used, are given. Author (ESA)

N80-28999# Royal Netherlands Meteorological Inst., De Bilt. Operationele Dienst.
WEATHER FORECASTING FOR THE CONSTRUCTION AND BUILDING INDUSTRY DURING THE WINTER 1978-1979 [RAPPORT BETREFFENDE DE WEERBERICHTGEVING VOOR DE BOUWNIJVERHEID IN DE WINTER 1978-1979]
J. J. Allan, A. P. A. Kleintjes, and D. M. vanderWoude 1979 32 p In DUTCH
(KNMI-V-330) Avail: NTIS HC A03/MF A01

The technical and organizational aspects of issuing forecasts for the construction industry are described, including the equipment required, forecast accuracy, and user acceptance. Weather data for the period are presented. Author (ESA)

N80-29000# National Technical Information Service, Springfield, Va.
HAIL: METEOROLOGY, DAMAGE, PREVENTION, AND FORECASTING. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Mar. 1980
Robena J. Brown Apr. 1980 72 p Supersedes NTIS/PS-79/0310; NTIS/PS-78/0257
(PB80-809692; NTIS/PS-79/0310; NTIS/PS-78/0257) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

A bibliography containing 65 abstracts addressing hail storms, hail formation, hail damage, and warning systems is presented. Atmospheric and cloud physics associated with hail, storm tracking storm forecasts, and meteorological instruments are covered. Studies on meteorological fronts and storms which accompany hail, and methods to modify these systems, are also cited. GRA

N80-29001# National Academy of Sciences - National Research Council, Washington, D. C. Climate Research Board.
CARBON DIOXIDE AND CLIMATE: A SCIENTIFIC ASSESSMENT
Jul. 1979 35 p refs Sponsored in part by Office of Science and Technology Policy, Washington, D.C.
(PB80-175250) Avail: NTIS HC A03/MF A01 CSCL 04B

Atmospheric concentrations of carbon dioxide are steadily increasing, and these changes are linked with man's use of fossil fuels and exploitation of the land. Since carbon dioxide plays a significant role in the heat budget of the atmosphere, it is reasonable to suppose that continued increases would affect climate. These concerns have prompted a number of investigations of the implications of increasing carbon dioxide. Their consensus has been that increasing carbon dioxide will lead to a warmer Earth with a different distribution of climatic regimes. In view

of the implications of this issue for national and international policy planning, the Office of Science and Technology Policy requested the National Academy of Sciences to undertake an independent critical assessment of the scientific basis of these studies and the degree of certainty that could be attached to their results. GRA

N80-29002# Military Academy, West Point, N. Y. Science Research Lab.
CHEMISTRY OF PRECIPITATION FROM SEQUENTIALLY SAMPLED STORMS Final Report, Oct. 1976 - Sep. 1978
J. K. Robertson, T. W. Dolzine, and R. C. Graham Jan. 1980 129 p refs
(PB80-166994; EPA-600/4-80-004) Avail: NTIS HC A07/MF A01 CSCL 04B

Sequential sampling techniques and applications to collect precipitation are reviewed. Chemical data for samples collected by an intensity-weighted sequential sampling device in operation at the U.S. Military Academy, West Point, New York from October 1976 to April 1978 are presented and discussed. The problem of dry deposition is explored. An intensity-weighted sequential sampler that excludes dry deposition is presented. The experiments show that intensity-weighted sequential sampling is a viable technique for monitoring the rapid changes in precipitation chemistry within a storm. Complete chemical data are needed from individual storms to evaluate intensity related scavenging. GRA

N80-29003# National Weather Service, Salt Lake City, Utah. Western Region.
MISINTERPRETATIONS OF PRECIPITATION PROBABILITY FORECASTS
Allan H. Murphy (Oregon State Univ.), Sarah Lichtenstein (Decision Research), Baruch Fischoff (Decision Research), and Robert L. Winkler (Indiana Univ.) Feb. 1980 23 p refs
(PB80-174576; NOAA-TM-NWS-WR-149; NOAA-80030701) Avail: NTIS HC A02/MF A01 CSCL 04B

A study of 79 residents of Eugene, Oregon who completed a questionnaire designed to investigate their understanding of probability of precipitation (PoP) forecasts is summarized. Results indicate that the event in question frequently is misunderstood, with both tranditional precipitation forecasts and PoP forecasts experiencing similar levels of event misinterpretation. Moreover, most respondents revealed a preference for the use of probabilities to express the uncertainty inherent in precipitation forecasts. GRA

N80-29004# Commerce Dept., Washington, D.C. Weather Modification Advisory Board.
NATIONAL WEATHER MODIFICATION POLICIES AND PROGRAMS: A REPORT TO THE PRESIDENT AND THE CONGRESS
Nov. 1979 150 p refs
(PB80-175821; NOAA-80022011) Avail: NTIS HC A07/MF A01 CSCL 04B

The National Weather Modification Policy Act of 1976 (P.L. 94-490), reproduced as appendix A, directed the Secretary of Commerce to conduct a comprehensive study of the status of weather modification science and technology and to submit to the President and the Congress a report on the findings, conclusions, and recommendations of the study. This is the report prepared pursuant to that Congressional directive. Modification of the weather is scientifically possible. If it is done reliably and with predictable results, society would benefit substantially, both economically and by saving of lives. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-29005*# National Aeronautics and Space Administration, Washington, D. C.
NASA OCEANIC PROCESSES PROGRAM: STATUS REPORT, FISCAL YEAR 1980
Jul. 1980 160 p
(NASA-TM-80233) Avail: NTIS HC A08/MF A01 CSCL 08C

Goals, philosophy, and objectives of NASA's Oceanic Processes Program are presented as well as detailed information on flight projects, sensor developments, future prospects, individual investigator tasks, and recent publications. A special feature is a group of brief descriptions prepared by leaders in the oceanographic community of how remote sensing might impact various areas of oceanography during the coming decade. L.F.M.

N80-29006# Naval Postgraduate School, Monterey, Calif.
STATISTICAL PROPERTIES OF OCEAN WAVE GROUPS M.S. Thesis
Arthur Ronald Nelson Mar. 1980 134 p refs
(AD-A084378) Avail: NTIS HC A07/MF A01 CSCL 08/3

Individual wave groups were identified by an analysis of digitized wave records. The analysis technique is based on a comparison between short-term variance and wave record variance. Once wave groups were identified, wave parameters of interest were then derived. Analysis was performed on 338 wave records obtained from a Waverider buoy covering a wide range of height, period, and steepness. Statistical relationships between the parameters obtained were determined for all wave groups, and for selected extreme wave groups. It was found that as the relative energy of the group increases the number of wavers per group increases, and the average group period approaches the spectral peak period. Wave steepness was shown, however, not to depend upon the group energy. Groups from low steepness wave records tend to contain larger numbers of waves. It was also shown that the height of the single highest wave in a group tends to approximate the significant height of the wave record. GRA

N80-29007# Naval Civil Engineering Lab., Port Hueneme, Calif.
A THIN FILM THERMAL SENSOR FOR MEASURING OCEAN CURRENTS Interim Report, Jul. 1976 - Jul. 1979
T. R. Kretschmer, B. C. Streets, and A. P. Smith Nov. 1979 43 p refs
(AD-A085286; CEL-TN-1564) Avail: NTIS HC A03/MF A01 CSCL 20/13

A thin film thermal sensor is being developed to improve U.S. Navy capabilities for measuring ocean current profiles. Using the sensor, current velocity is determined by measuring the resistance changes in each of four platinum films positioned on the surface of the cylindrical sensor substrate. Development of this device into a practical ocean going tool has involved overcoming substrate fragility, water leakage problems, and biofouling contamination. A high strength ceramic substrate has been selected to improve ruggedness. New coating systems to prevent water penetration into the sensor are being developed and evaluated. An electrolytic hypochlorite generation technique has been developed to prevent biofouling indefinitely on the sensor surface. Tests have shown the sensor produces repeatable results in the laboratory and agrees well with commercial current meter measurements during ocean testing. GRA

N80-29008# Brookhaven National Lab., Upton, N. Y.
SPAR BUOY OCEANOGRAPHIC TELEMETRY SYSTEM OPERATIONAL MODIFICATIONS
E. Divis, T. Hopkins, V. Pfeiffer, and D. Carlson Dec. 1979 13 p ref
(Contracts EY-76-C-02-0016; DE-AC02-76CH-00016)
(BNL-51139) Avail: NTIS HC A02/MF A01

The mechanical and electronic performance of the Spar Buoy System, SBOTS (Spar Buoy Oceanographic Telemetry System), is evaluated with special reference to modifications and repairs that have enhanced the probability of continued success, both in operational deployment and data recovery. To invest the SBOTS system with a reliability which would anticipate all possible hazards would be desirable, although impossible; as an adjunct to this goal, a brief description of the repairs, modifications, and changes which were initiated to increase reliability during deployment is presented. DOE

N80-29009# Woods Hole Oceanographic Institution, Mass.
CALCULATION OF MEAN SEASONAL SEA SURFACE ELEVATION FIELDS OVER THE NORTH ATLANTIC CONTINENTAL SHELF AND SLOPE USING HISTORICAL HYDRO-

STATION DATA
James H. Churchill Feb. 1980 93 p refs
(Contract DE-AC02-79EV-10005)
(PB80-170707; WHOI-80-9) Avail: NTIS HC A05/MF A01 CSCL 08C

The calculation and results of a coastal elevation field model are presented. Seasonal mean sea surface elevation fields were calculated over the shelf slope region off the east coast of North America north of Cape Hatteras by applying the model to a grid of averaged sigma-t's at standard depths. The sigma-t grid was calculated using a data base of approximately 30,000 hydrographic stations. Difficulties involved with the numerical implementation of the model and economizing adaptations to the WHOI-NODC data processing program, OCCOMP, are discussed. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-29010*# National Aeronautics and Space Administration, Washington, D. C.
ELECTROENCEPHALOGRAPHIC CHANGES IN ALBINO RATS SUBJECTED TO STRESS
J. Mercier, G. Assouline, and J. Fondarai Apr. 1980 8 p ref Transl. into ENGLISH from OMPT Rend. Soc. Biol. (France), v. 161, no. 7, Jun. 1967 p 1639-1641 Presented at Marseilles Biol. Soc. Meeting, 20 Jun. 1967 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Med. and Pharm. Fac. of Marseilles
(Contract NASw-3199)
(NASA-TM-76118) Avail: NTIS HC A02/MF A01 CSCL 06C

Twenty one albino Wistar rats were subjected to stress for 7 hours. There was a significant difference in the slopes of regression lines for 7 nonulcerous rats and those for 14 ulcerous rats. Nonulcerous rats subjected to stress showed greater EEG curve synchronization than did ulcerous rats. If curve synchronization can be equated to a relaxed state, it may therefore be possible to explain the protective action of hypnotics, tranquilizers and analgesics on ulcers. Author

N80-29011*# Miami Univ., Coral Gables, Fla. Inst. for Molecular and Cellular Evolution.
FROM INANIMATE MATTER TO LIVING SYSTEMS
Sidney W. Fox 27 May 1980 33 p refs
(Grant NGR-10-007-008)
(NASA-CR-163372) Avail: NTIS HC A03/MF A01 CSCL 06C

Since the early part of this century, the Genesis account of the origin and evolution of life has been explained as an extrapolation of astronomical and geochemical processes. The essence of the answer to date is a protoreproductive protocell of much biochemical and cytophysical competance. The processes of its origin, molecular ordering, and its functions are described. A crucial understanding is that of the nonrandomness of evolutionary processes at all stages (with perhaps a minor statistical component). In this way, evolution conflicts with statistical randomness; the latter is a favorite assumption of both scientific and creationistic critics of the proteinoid theory. The principle contribution of the proteinoid theory to the understanding of general biology is to particularize the view that evolutionary direction is rooted in the shapes of molecules, in stereochemistry. After molecules of the right kind first assembled to protocells, life in its various stages of evolution was an inevitable consequence. It is molecules that continue to assemble as part of living process and, in the role of enzymes, continue to direct life cycle of the cell. A.R.H.

N80-29012*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECT OF HYPODYNAMIA ON THE STRUCTURE OF THE INTRAORGANIC BLOOD VESSELS AND THE CAPACITY OF THE BLOOD STREAM IN THE DIAPHRAGM OF WHITE RATS
A. I. Gerus May 1980 11 p refs Transl. into ENGLISH from Vestsi Akad. Navuk BSSR, Ser. Biyal. Navuk (USSR), no. 3, 1974 p 94-98 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76140) Avail: NTIS HC A02/MF A01 CSCL 06C

The effect of hypodynamia on the vascular system of white rats with diaphragm deprivation was investigated. Morphological changes in the intraorganic blood stream of the diaphragm were determined. The capacity of the intraorganic vascular flow within the diaphragm muscles was established. R.E.S.

N80-29013*# National Aeronautics and Space Administration, Washington, D. C.
GENETIC CHANGES INDUCED BY SPACE FLIGHT FACTORS IN BARLEY SEEDS ON SOYUZ-6 AND SOYUZ-9 CRAFT
N. I. Nuzhdin and R. L. Dozortseva Jul. 1980 17 p refs Transl. into ENGLISH from Zh. Obshch. Biol. (USSR), v. 33, no. 2, 1972 p 336-346 Translation was announced as N70-23662 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76281) Avail: NTIS HC A02/MF A01 CSCL 06C

Air-dry seeds of the barley Zimujuschij moscowskyi of the 1969 harvest were taken into space onboard the spaceships Soyuz-5 and Soyuz-9. A cytological study of the mitoses in meristemic cells in rootlet terminals revealed that space flight factors (SFF) in nonirradiated seeds induced about 3% of aberrant cells. After irradiation the effect of SFF increased over two-fold. Although the radio protectors ensured the seeds against from the SFF-induced damage either in irradiated or nonirradiated seed cells which is inconsistent with the previously obtained data. L.F.M.

N80-29014*# National Aeronautics and Space Administration, John F. Kennedy Space Center, Cocoa Beach, Fla.
RESPONSE OF SELECTED PLANT AND INSECT SPECIES TO SIMULATED SOLID ROCKET EXHAUST MIXTURES AND TO EXHAUST COMPONENTS FROM SOLID ROCKET FUELS
William W. Heck (Department of Agriculture), William M. Knott, Edward P. Stahel (North Carolina State Univ.), John T. Ambrose (North Carolina State Univ.), James N. McCrimmon (North Carolina State Univ.), Madeleine Engle (North Carolina State Univ.), Louse A. Romanow (North Carolina State Univ.), Alan G. Sawyer (North Carolina State Univ.), and James D. Tyson (North Carolina State Univ.) Aug. 1980 158 p refs
(NASA-TM-74109; KSC-TR-51-1) Avail: NTIS HC A08/MF A01 CSCL 06C

The effects of solid rocket fuel (SRF) exhaust on selected plant and and insect species in the Merritt Island, Florida area was investigated in order to determine if the exhaust clouds generated by shuttle launches would adversely affect the native, plants of the Merritt Island Wildlife Refuge, the citrus production, or the beekeeping industry of the island. Conditions were simulated in greenhouse exposure chambers and field chambers constructed to model the ideal continuous stirred tank reactor. A plant exposure system was developed for dispensing and monitoring the two major chemicals in SRF exhaust, HCl and Al2O3, and for dispensing and monitoring SRF exhaust (controlled fuel burns). Plants native to Merritt Island, Florida were grown and used as test species. Dose-response relationships were determined for short term exposures of selected plant species to HCl, Al2O3, and mixtures of the two to SRF exhaust. R.E.S.

N80-29015*# National Aeronautics and Space Administration, Washington, D. C.
ULCERS IN RESTRAINED RATS: STUDY OF PROTECTIVE SUBSTANCES
L. Buche and D. Gallaire May 1980 21 p refs Transl. into ENGLISH from Arch. Sci. Physiol. (France), v. 21, no. 4, 1967 p 537-552 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Pharmacology Inst.
(Contract NASw-3199)
(NASA-TM-76184) Avail: NTIS HC A02/MF A01 CSCL 06C

The genesis of ulcers in restrained rats is discussed through an investigation of the relationship between the protective effects of nervous system effectual substances examined vis-a-vis ulcers in restrained rats and their elective or secondary pharmacologic effects. The substances used were capable of either peripheral parasympatholytic, sympatholytic, ganglioplegic, spasmolytic effects or central, hypnotic, tranquilizing, neuroleptic, analgesic effects. The regular and considerable protection observed with parasympatholytics (atropine sulfate, benzylonium bromide, dihexyverine, J.L. 1344) and a ganglioplegic (pentamethonium) is a function of their anticholinergic properties. It is of less importance with dibenamine, a sympatholytic action on the adrenergic receptors. Among the central depressive substances tested (hypnotics, tranquilizers, neuroleptics, analgesic), phenobarbital at a nonhypnotic dose, and dextromoramide at a nonanalgesic dose, show antiulcerous effects, which are found with chlorpromazine only at cataleptogenic doses. M.G.

N80-29016*# National Aeronautics and Space Administration, Washington, D. C.

EFFECT OF CERTAIN PSYCHOPHARMACOLOGICAL PREPARATIONS ON ADAPTATION UNDER STRESS CONDITIONS

A. V. Stanishevskaya and L. N. Mezentseva Jun. 1980 7 p refs Transl. into ENGLISH from Farakol. Toksikol. (USSR), v. 40, no. 1, 1977 p 9-12 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76185) Avail: NTIS HC A02/MF A01 CSCL 06C

Experiments staged on rats demonstrated that the formation of pathological states caused by stress and accompanied by the development of ulcerative lesion of the gastric mucosa are associated with the degree of the catecholamines level drop in the mesencephalon and hypothalamus. The application of seduxen and also of combinations consisting of L-DOPA with seduxen, or with an L-adrenoblocking agent pyroxan tends to reduce the frequency of developing alcerative lesions of the stomach. The protective effect produced by the combination of L-DOPA with an L-adrenoblocking agent pyroxan is barred by an additional administration of an B-adrenoblocking agent, inderal. Author

N80-29017# Wyoming Univ., Laramie. Dept. of Zoology and Physiology.

PARAMECIUM TETRAURELIA: PRESCREEN FOR HAZARDOUS AGENTS

J. Smith-Sonneborn, C. Herr, and E. VanKirk 1979 37 p refs

(Contract DE-AC02-77EV-04477)

(DOE/EV-04477/1) Avail: NTIS HC A03/MF A01

The ciliated protozoan, paramecia, is proposed as a eukaryote model system for use in short term screening assays for detection of mutagenic/carcinogenic and hazardous agents. The approach utilizes two assays: the mutagenic and photodynamic systems. DOE

N80-29018# WIL Research Labs., Inc., Cincinnati, Ohio.

TERATOLOGIC EFFECTS OF LONG-TERM EXPOSURE TO DIESEL EXHAUST EMISSIONS (RATS) Progress Report, 15 Sep. 1978 - 7 Feb. 1979

Kathleen M. Werchowski, Vincent W. Chaffee, and G. Bruce Briggs Jan. 1980 41 p

(Contract EPA-68-03-2652)

(PB80-159965; EPA-600/1-80-010) Avail: NTIS HC A03/MF A01 CSCL 06T

The potential for diesel exhaust emissions to produce malformations in rat fetuses was investigated. The rats were exposed by the inhalation route to a 10% concentration of diesel exhaust emissions in inhalation chambers on days 6 through 15 of gestation. (Methods used conform to the guideline developed by the Food and Drug Administration for evaluating teratogenic effects in rats.) The results of the exposure of pregnant rats indicate that diesel exhaust emissions have no effect upon normal development of rat fetuses. Diesel exhaust emissions did not effect any of the parameters evaluated to assess maternal toxicity nor total number of fetuses born. GRA

N80-29019# WIL Research Labs., Inc., Cincinnati, Ohio.

TERATOLOGIC EFFECTS OF LONG-TERM EXPOSURE TO DIESEL EXHAUST EMISSION (RABBITS) Progress Report, 19 Dec. 1978 - 25 May 1979

Kathleen M. Werchowski, Stephen P. Henne, and G. Bruce Briggs Jan. 1980 49 p

(Contract EPA-68-03-2652)

(PB80-168529; EPA-600/1-80-011) Avail: NTIS HC A03/MF A01 CSCL 06T

The potential for diesel exhaust emissions to produce malformation in rabbit fetuses was evaluated. The pregnant does were exposed by the inhalation route to a 10% concentration of diesel exhaust emissions in inhalation chambers on days 6 through 18 of gestation (Methods used conform to the guideline developed by the Food and Drug Administration for evaluating teratogenic effects in rabbits.) The results of the exposure of pregnant rabbits indicate that diesel exhaust emissions have no effect upon the normal development of rabbit fetuses. Diesel exhaust emission did not effect any of the parameters evaluated to assess maternal toxicity nor total number of fetuses born. GRA

N80-29020# Michigan State Univ., East Lansing. Inst. of Water Research.

AN EMPIRICAL STUDY OF FACTORS AFFECTING BLUE-GREEN VERSUS NONBLUE-GREEN ALGAL DOMINANCE IN LAKES Project Completion Report, 1 Oct. 1978 - 30 Sep. 1979

Kenneth H. Reckhow and Jonathan T. Simpson Feb. 1980 108 p refs

(Contract DI-14-34-0001-9024)

(PB80-169311; W80-04441; OWRT-A-102-MICH(3)) Avail: NTIS HC A06/MF A01 CSCL 06C

Exploratory data analysis techniques were applied to 90 north temperate lakes included in the EPA National Eutrophication Survey to examine empirical relationships between: (1) the chemical and physical variables that affect algal dominance in lakes; and (2) the dominant algal type. Single variable box plots and bivariate-discriminant plots document the importance of the inorganic nitrogen concentration and hydraulic detention time in determining blue-green versus nonblue-green algal dominance in eutrophic lakes. The multivariate statistical technique of discriminant analysis was also applied to 68 high, alkalinity lakes in the data set to: (1) further identify variable relationships; and (2) construct a simple predictive model for algal dominance. GRA

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-29021* National Aeronautics and Space Administration, Washington, D. C.

AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES

Jul. 1980 53 p

(NASA-SP-7011(208)) Avail: NTIS HC A04 CSCL 06E

This bibliography lists 138 reports, articles, and other documents introduced into the NASA scientific and technical information system in Jun. 1980. Author

N80-29022# National Electrical Engineering Research Inst., Pretoria (South Africa).

CHANGES IN THE QRS COMPLEX OF THE ELECTROCARDIOGRAM DURING SLEEP AND EXERCISE M.S. Thesis - Pretoria Univ.

John Nicholas Amoore May 1979 178 p refs

(CSIR-ELEK-167) Avail: NTIS HC A09/MF A01

Changes in the QRS complex in normal healthy individuals during sleep were identified and studied in order to determine whether they are due to alteration in the cardiac signal or in the transfer function. A knowledge of the mechanism of the changes could provide useful information on the nature of sleep. The following conclusions were reached: (1) The surface ECG is a function of both the electrical activity of the heart and the transfer of the signals to the body surface. (2) An analysis of the transfer function extends the usefulness of the ECG. (3) Three modes of R and S amplitude changes occur during sleep.

The abrupt change in mean value, the beat by beat variability of the amplitudes and the gradual change of mean amplitude may assist the analysis of sleep. (4) The response of the QRS waveform to inspiration has two components, namely a step response caused by movement of the heart with the diaphragm, and a transient response possibly caused by ventricular volume changes. (5) The amplitudes of the R and S waves change in a defined pattern during exercise. (6) Changes of the R and S wave amplitudes may reflect changes in left ventricular end diastolic volume. R.E.S.

N80-29023*# GARD, Inc., Niles, Ill.
DESIGN, FABRICATION AND TESTING OF A DUAL CATALYST AMMONIA REMOVAL SYSTEM FOR A URINE VCD UNIT Final Report
P. Budinikas Jun. 1980 43 p ref
(Contract NAS2-10237)
(NASA-CR-152372) Avail: NTIS HC A03/MF A01 CSCL 06B

A three-man capacity catalytic system for the recovery of water from urine was designed, constructed, and tested. It was designed to operate with feed streams containing high concentrations of urine vapor and only 5 to 7% of oxygen for the oxidation of ammonia and volatile organic vapor.It can operate either in a flow-through or a recycle mode and is capable of accepting the urine vapor produced by a vapor compression distillation evaporator. Testing consisted of short preliminary and optimization test, an endurance test of 74 hours continuous operation, and recycle tests using both air and oxygen. The system was designed for a urine processing rate of 0.86 liters/hr; however, it was tested at rates up to 1.2 liter/hr. Untreated urine evaporated by an electrically heated evaporator was used. The quality of the recovered water meets the U.S. Drinking Water Standards, with the exception of a low pH. Accumulation of solids in the urine sludge is reduced to approximately 65% of the anticipated value. L.F.M.

N80-29024*# Houston Univ., Clear Lake, Tex.
ASTRONAUT TRAINING MANUAL Final Report
Eugene A. Coleman 30 Jun. 1980 251 p refs
(Contract NAS9-15642)
(NASA-CR-160758) Avail: NTIS HC A12/MF A01 CSCL 05I

Scientific information from previous space flights, space medicine, exercise physiology, and sports medicine was used to prepare a physical fitness manual suitable for use by members of the NASA astronaut population. A variety of scientifically valid exercise programs and activities suitable for the development of physical fitness are provided. Programs, activities, and supportive scientific data are presented in a concise, easy to read format so as to permit the user to select his or her mode of training with confidence and devote time previously spent experimenting with training routines to preparation for space flight. The programs and activities included were tested and shown to be effective and enjoyable. E.D.K.

N80-29025*# National Aeronautics and Space Administration, Washington, D. C.
EFFECT OF RESTRICTED MOBILITY ON RNA CONTENT AND NUCLEOTIDE COMPOSITION AND ON PROTEIN CONTENT IN MOTONEURONS OF SPINAL CORD ANTERIOR HORNS
A. V. Gorbunova Jun. 1980 7 p Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 199, no. 4, 1971 p 976-979 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prep. by Inst. of Med. and Biol. Problems, USSR Min. of Public Health
(Contract NASw-3198)
(NASA-TM-76190) Avail: NTIS HC A02/MF A01 CSCL 06S

An investigation into the effect of hypokinesia on the ribonucleic acid (RNA) content, the nucleotide composition, and dynamics of protein content in the motoneuron of the rat spinal cord anterior horns is described. Methodology and findings are presented. The study results showed that the nucleotide composition of the total cellular RNA at all the studied periods of hypokinesia remained unchanged and is characteristic for the cytoplasmic, high polymer ribosomal RNA. This means that with a change in the functional state of the neuron the newly formed RNA of the nerve cell has the same composition of bases as the original RNA that belongs to the ribosomal type. Author

N80-29026*# National Aeronautics and Space Administration, Washington, D. C.
RNA CONTENT IN SPINAL CORD MOTONEURONS DURING HYPOKINESIA
A. V. Gorbunova Jun. 1980 9 p refs Transl. into ENGLISH from Tsitologiya (USSR), v. 13, no. 1, Jan. 1971 p 83-87 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by USSR Ministry of Public Health
(Contract NASw-3198)
(NASA-TM-76200) Avail: NTIS HC A02/MF A01 CSCL 06S

The effect of a diminished motor activity of rats upon the ribonucleic and (RNA) content in a single isolated motoneuron of frontal of their spinal cord was studied. Within a 1 to 30 day exposure of rats to the hypokinetic conditions, RNA content was found to decrease on the 1st, 3rd, and 5th day and to return to the initial level by the 7th day. No changes in RNA content were observed during the subsequent stages of the experiments. The volume of the nerve cells declined on the 3rd and 5th day, whereas RNA concentration reduced on the 1st, 3rd, 5th, and 30th day. L.F.M.

N80-29027*# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
A COMPUTER IMPLEMENTATION OF A THEORY OF HUMAN STEREO VISION
W. E. L. Grimson Jan. 1980 62 p refs
(Contract N00014-75-C-0643; Grant NSF MCS-77-07569)
(AD-A084696; AI-M-565) Avail: NTIS HC A04/MF A01 CSCL 06/16

Recently, Marr and Poggio (1979) presented a theory of human stereo vision. An implementation of that theory is presented, and consists of five steps: (1) The left and right images are each filtered with masks of four sizes that increase with eccentricity; the shape of these masks is given by the laplacian of a Gaussian function. (2) Zero-crossings in the filtered images are found along horizontal scan lines. (3) For each mask size, matching takes place between zero-crossings of the same sign and roughly the same orientation in the two images, for a range of disparities up to about the width of the mask's central region. Within this disparity range, Marr and Poggio showed that false targets pose only a simple problem. (4) The output of the wide masks can control vergence movements, thus causing small masks to come into correspondence. In this way, the matching process gradually moves from dealing with large disparities at a low resolution to dealing with small disparities at a high resolution. (5) When a correspondence is achieved, it is stored in a dynamic buffer, called the 2 1/2 dimensional sketch. To support the sufficiency of the Marr-Poggio model of human stereo vision, the implementation was tested on a wide range of stereograms from the human stereopsis literature. The performance of the implementation is illustrated and compared with human perception. As well, statistical assumptions made by Marr and Poggio are supported by comparison with statistics found in practice. Finally, the process of implementing the theory has led to the clarification and refinement of a number of details within the theory; these are discussed in detail. GRA

N80-29028# Wayne State Univ., Detroit, Mich. Ergonomics Research Lab.
A TECHNIQUE FOR ESTABLISHING TRUE LEVELS OF MUSCLE STRENGTH EXERTION Final Report, 1 Jun. 1979 - 31 Jan. 1980
K. H. E. Kroemer and W. S. Marras Jan. 1980 85 p refs
(Contract F49620-79-C-0109; AF Proj. 2313)
(AD-A083576; AFOSR-80-0263TR) Avail: NTIS HC A05/MF A01 CSCL 06/16

Experiments were performed with 20 female and 20 male subjects in order to determine indicators of whether the subjects performed maximal or submaximal isometric strength exertion. The exertion tested were elbow flexion, finger flexion, knee flexion and knee extension. The only performance measures used were analog recordings of the strength scores exerted on a static dynamometer. The following was found: (1) The variability of

tests scores in repeated exertion is not a viable indicator of the actual portion of individual strength exerted. (2) The buildup phase of strength exertion is a reliable indicator of the force level to be attained. The steeper the strength formation curve, the stronger the following muscle strength exertion. GRA

N80-29029# Oak Ridge National Lab., Tenn. Health and Environmental Studies Program.
CHEMICAL IDENTIFIED IN HUMAN BIOLOGICAL MEDIA: A DATA BASE, VOLUME 1, PART 1, RECORDS 1-1580 Annual Report, Oct. 1979
M. Virginia Cone, comp., Margaret F. Baldauf, comp., Fay M. Martin, comp., and John T. Ensminger, comp. Mar. 1980 314 p refs
(Contract W-7405-eng-26)
(ORNL/EIS-163/V1-P1; APR-1) Avail: NTIS HC A14/MF A01

A comprehensive data base of chemicals identified in human biological media (tissues and body fluids) is presented in two volumes. The data base in given in this volume in tabular form and arranged alphabetically by CAS 'preferred chemical name'. R.E.S.

N80-29030# Oak Ridge National Lab., Tenn. Health and Environmental Studies Program.
CHEMICALS IDENTIFIED IN HUMAN BIOLOGICAL MEDIA: A DATA BASE, VOLUME 1, PART 2, RECORDS 1-1580 Annual Report, Oct. 1979
M. Virginia Cone, comp., Margaret F. Baldauf, comp., Fay M. Martin, comp., and John T. Ensminger, comp. Mar. 1980 816 p refs
(Contract W-7405-eng-26)
(ORNL/EIS-163/V1-P2; APR-1) Avail: NTIS HC A99/MF A01

A comprehensive data base of chemicals identified in human biological media (tissues and body fluids) is presented in two volumes. Introductory material, references, appendices, indices, and a chemical directory are given in this volume as a user guide to the data base. R.E.S.

N80-29031# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
INITIAL STUDY ON THE EFFECTS OF TRANSFORMER AND TRANSMISSION LINE NOISE ON PEOPLE. VOLUME 1: ANNOYANCE Final Report
K. S. Pearsons, R. L. Bennett, and S. A. Fidell Dec. 1979 114 p refs Sponsored by DOE 3 Vol.
(EPRI-EA-1240-Vol-1; EPRI-RP852-Vol-1) Avail: NTIS HC A06/MF A01

The relative annoyance of transmission line and transformer noise along with shaped noise and other environmental noises was evaluated in a laboratory setting. Thirty-two test subjects made paired comparisons of the annoyance of 19 signals under free field listening conditions. The study shows that transformer noise is about 10 decibles more acceptable than transmission line noise and thus casts doubt on the general validity of the A-weighted sound level index as a predictor of the relative noise annoyance of transformer noise as compared to transmission line corona noise. The inadequacy of the dBA as a unit for assessing certain types of relative noise evaluation is confirmed. DOE

N80-29032# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
INITIAL STUDY ON THE EFFECTS OF TRANSFORMER AND TRANSMISSION LINE NOISE ON PEOPLE. VOLUME 2: SLEEP INTERFERENCE Final Report
R. D. Horonjeff, R. L. Bennett, and S. R. Teffeteller Dec. 1979 68 p refs Sponsored by Electric Power Research Inst. 3 Vol.
(EPRI-EA-1240-Vol-2; EPRI-RP852-Vol-2) Avail: NTIS HC A04/MF A01

The relative awakening potential of four different sounds (a transformer, transmission line, window air conditioner, and distant traffic) was evaluated in a behavioral awakening study conducted in peoples' own homes. Fourteen participants in the Los Angeles, California area each participated in the experiment for a three week period. The results of the study indicate that the transformer, air conditioner, and traffic sounds would all awaken essentially the same proportion of the test population when presented at the same A-weighted sound level. The transmission line around, however, had to be presented at a level 10 dB(A) less than the other sounds to awaken an equivalent proportion of the population. DOE

N80-29033# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
INITIAL STUDY ON THE EFFECTS OF TRANSFORMER AND TRANSMISSION LINE NOISE ON PEOPLE. VOLUME 3: COMMUNITY REACTION Final Report
S. A. Fidell, S. R. Teffeteller, and K. S. Pearsons Dec. 1979 61 p refs 3 Vol.
(EPRI-EA-1240-Vol-3; EPRI-RP852-Vol-3) Avail: NTIS HC A04/MF A01

A social survey intended to assess reactions to exposure to noise emissions of overhead electric power transmission lines and power transformers was conducted in Southern California. A structured questionnaire was administered by personal interview to a purposive sample of about 400 people residing at 17 sites along power line rights-of-way and in neighborhoods adjacent to transformer substations in urban areas. Estimates of the proportion of the American population exposed to noise of different levels from power lines and transformers were developed by analyses of several information sources. Acoustic measurements were made at all interviewing sites to assess the contributions of these low level electrical noise sources to overall background noise environments. DOE

N80-29034# Oak Ridge National Lab., Tenn. Industrial Safety and Applied Health Physics Div.
HEALTH EFFECTS OF LOW LEVEL RADIATION
John A. Auxier 1980 13 p
(Contract W-7405-eng-26)
(DOE/TIC-11176) Avail: NTIS HC A02/MF A01

The health and environmental effects of low level radiation are reviewed. Emphasis is placed on effects on bone marrow and incidence of leukemia. Dose response curves are presented. DOE

N80-29035# CarboMedics, Inc., San Diego, Calif.
STUDIES OF CARBON-SURFACED POLYMERIC, METALLIC AND CERAMIC BIOMATERIALS Annual Report, 1 Apr. 1978 - 31 Mar. 1979
A. D. Haubold and H. S. Shim Dec. 1979 71 p refs
(Contract N01-HV-4-2928)
(PB80-168859) Avail: NTIS HC A04/MF A01 CSCL 06B

Carbon-surfaced composite biomaterials were investigated in order to: (1) determine whether thin carbon films that have physical and chemical properties similar to those of LTI carbon also confer the biochemical properties of LTI carbon to the coated composites, and (2) determine if the carbon-surfaced composites possess the necessary engineering properties for use in prosthetic devices. It was found that the strain to failure of carbon films on polymeric substrates is on the order of 4 to 5%. Failure of the carbon coating always coincided with the onset of plastic deformation in the substrate. The adhesion of the thin coatings is greater than the bulk strength of the polymer. GRA

N80-29036# National Technical Information Service, Springfield, Va.
AIRCRAFT SONIC BOOM: BIOLOGICAL EFFECTS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
Elizabeth A. Harrison May 1980 89 p Supersedes NTIS/PS-79/0190; NTIS/PS-78/0120
(PB80-810310; NTIS/PS-79/0190; NTIS/PS-78/0120) Avail: NTIS HC $30.00/MF $30.00 CSCL 06S

The selected abstracts of research reports cover the effects of sonic booms on humans, animals, birds, and fish. Discussions of biophysics, psychoacoustics, stress, and auditory tolerances are presented, along with materials on startle responses, disturbance, and compression wave reactions. This updated bibliography contains 82 abstracts. GRA

N80-29037# National Technical Information Service, Springfield, Va.
HYPOTHERMIA. CITATIONS FROM THE NTIS DATA BASE

Progress Report, 1964 - May 1980
Elizabeth A. Harrison May 1980 257 p Supersedes NTIS/PS-79/0533; NTIS/PS-78/0517
(PB80-180526; NTIS/PS-79/0533; NTIS/PS-78/0517) Avail: NTIS HC $30.00/MF $30.00 CSCL 06S

The selected abstracts cover high pressure narcosis, organ preservation, hyperbaric conditions, thermal homeostasis, thermoregulation, cold stress, cold tolerance, physiological effects and cold water immersion as related to hypothermia. This updated bibliography contains 250 abstracts. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-29038 Flying Personnel Research Committee, London (England).
RESEARCH ABSTRACTS IN THE BEHAVIOURAL SCIENCES, 1971 TO 1975: A BIBLIOGRAPHY
Oct. 1979 55 p
(FPRC-Memo-259; BR70999) Copyright. Avail: Issuing Activity

Abstracts of 122 papers representing work completed by the Royal Air Force between 1971 and 1975 are presented. Subjects studied include: general psychology; group and interpersonal processes; military structure and political processes; personal atitudes and evaluation; aviation medicine; physiological psychology and psychopharmacology; stress and performance; flight simulation; human factors and equipment design; ergonometrics of both air traffic control systems; and map design. Author (ESA)

N80-29039# Toronto Univ. (Ontario). Inst. for Aerospace Studies.
THE EFFECT OF A PREDICTIVE WIND SHEAR CHART ON PILOT LANDING PERFORMANCE
Eric Nick Solowka Apr. 1980 82 p refs Sponsored by National Research Council of Canada
(UTIAS-TN-220; ISSN-0082-5263) Avail: NTIS HC A05/MF A01

A fixed base aircraft simulator limited to providing only the longitudinal equations of motion was used to study the effect of a predictive wind shear chart on landing performance through wind shear. It was found that the introduction of the predictive wind shear chart alone did not significantly alter the pilot's landing performance. Training as to wind shear effect and limited coaching combined with the presence of the predictive shear display did however improve pilot ability to maintain the aircraft on the desired flight path with little effect on airspeed control. This inability to improve airspeed control might not be an indication of poor pilot performance but suggests the adoption of another airspeed performance criterion. The overreaction of pilots to a novel wind shear (that was slightly different from those used in training flights) when the wind shear chart was available to them indicates that although better glide slope control can be achieved, care will have to be exercised when introducing a predictive shear display to the general aviation field. R.E.S.

N80-29040# Analytics, Inc., Willow Grove, Pa.
DECISION AIDS FOR NAVAL AIR ASW Technical Report, Aug. 1978 - Aug. 1979
Wayne W. Zachary 15 Mar. 1980 136 p refs
(Contract N00014-78-C-0743; NR Proj. 199-003)
(AD-A085134; Rept-1366-A) Avail: NTIS HC A07/MF A01 CSCL 15/7

This report examines the applicability of a variety of decision aiding techniques to operation decision situations encountered in Naval Air Anti-Submarine Warfare (ASW). Decisions performed by the Tactical Coordinator (TACCO) in the three major Navy air ASW platforms, P-3C, S-3A, and LAMPS MK-III, are examined and synthesized into six decision making situations. These six situations are lost contact reacquisition, contact classification/verification, on-station search, localization, surveillance tracking, and attack planning. They represent distinct decision making contexts in which specific mission objectives are sought. A method for prioritizing these decision situations for decision and construction is developed and applied. A survey of numerous decision aids and a detailed analysis of 15 military decision aids results in the development of a six category taxonomy of decision aiding techniques. Possible combinations of techniques that could be applied to aid each of the decision situations are determined by matching the decision aiding techniques from the taxonomy to the detailed descriptions of the decision situations. The matching of techniques to situations is facilitated by the development of a descriptive framework for the decision situations. The categories in this framework are chosen so as to uncover the aspects of the situations most amenable to decision aiding by the techniques in the taxonomy. GRA

N80-29041# Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex. Clinical Research Div.
AUTOMATED PSYCHOLOGICAL STRESS DETECTION IN AN ENTRY PORTAL SYSTEM Final Report
Jerry G. Davis, Jack A. Loeppky, and Michael D. Venters Oct. 1979 35 p refs
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-80-7026) Avail: NTIS HC A03/MF A01

The application of automatic psychological stress detection to persons entering a secured facility through an entry portal is discussed. The numerous technical considerations in transducing the required physiological signals are presented. The major methods that a psychologically stressed person might utilize in an attempt to evade detection are also discussed. The prime evasionary method of drug intervention is given added emphasis. The hardware requirements for a typical installation are presented. DOE

N80-29042# Institut de Recherche de Transports, Bron (France). Centre d'Evaluation et de Recherche des Nuisances.
EFFECTS OF AIRCRAFT NOISE ON SLEEP: AN IN-SITU EXPERIENCE
M. Vallet, J. M. Gagneux, and F. Simonet 1979 10 p refs Presented at 3d Intern. Congr. on Noise as a Public Health Problem Sponsored by Min. de l'Environ. and Direc. de l'Aviation Civile
Avail: NTIS HC A02/MF A01

Electroencephalogram data and bedroom noise levels were recorded during four consecutive nights for 40 men living near the Roissy Airport in Paris questionnaire about sleep quality was administered each morning. All subjects had lived in the same location before the opening of the airport, and had been exposed to the noise for at least a year. The immediate effects of each noise event were noted and an analysis made of sleep structure. For the noisiest nights, total sleep decreased as the noise increased sleep induction latency increased with the noise index, and stage three and four sleep increase were noted. Author (ESA)

N80-28812*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A VERY LONG BASELINE INTERFEROMETRY SKY SURVEY
Robert A. Preston and D. D. Morabito *In* NASA. Goddard Space Flight Center Radio Interferometry Jul. 1980 p 173-179 refs (For primary document see N80-28798 19-43)
(Contract NAS7-100)
Avail: NTIS HC A20/MF A01 CSCL 08E

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-29043*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ENVIRONMENTAL CONTROL AND LIFE SUPPORT SYSTEM: ANALYSIS OF STS-1
G. J. Steines Jul. 1980 38 p refs
(NASA-TM-81032; JSC-16730; Rept-80-FM-36) Avail: NTIS

HC A03/MF A01 CSCL 06K

The capability of the orbiter environmental control and life support system (ECLSS) to support vehicle cooling requirements in the event of cabin pressure reduction to 9 psia was evaluated, using the Orbiter versions of the shuttle environmental consumables usage requirement evaluation (SECURE) program, and using heat load input data developed by the spacecraft electrical power simulator (SEPS) program. The SECURE model used in the analysis, the timeline and ECLSS configuration used in formulating the analysis, and the results of the analysis are presented. The conclusion which may be drawn drom these results, is summarized. There are no significant thermal problems with the proposed mission. There are, however, several procedures which could be optimized for better performance: setting the cabin HX air bypass and the interchanger water bypass to the zero flow position is of questionable efficacy; the cabin air pressure monitoring procedure should be re-evaluated; and the degree of equipment power down specified for this analysis and no problems were noted. A.R.H.

N80-29044# Naval Postgraduate School, Monterey, Calif.
THE ADVANTAGE OF THE COLOR-CODE MODALITY VERSUS ALPHANUMERIC AND SYMBOL CODE M.S. Thesis
Henning Hoops Mar. 1980 68 p refs
(AD-A084383) Avail: NTIS HC A04/MF A01 CSCL 05/8

This study describes an experiment designed to investigate potential advantages and/or disadvantages of color-coding relative to symbol - or alphanumeric-codes. Performance was evaluated in terms of reaction time and the number and type of errors made. The stimuli used in the experiment were the letters: E, F, N, U, the colors: red, yellow, green, blue, and the symbols: square, triangle, circle, and cross. They stood for enemy, friendly, neutral, and unknown forces, respectively. The analysis of the data obtained from the experiment suggested that the color and symbol-codes were significantly better than the alphanumeric-code with respect to the number of errors. The reaction time of the color-code was shortest, followed by the symbol-code with reaction time for the alphanumerics being longest. GRA

N80-29045# Donrich Research, Inc., West Palm Beach, Fla.
DETERMINATION OF THE IMPACT OF DIGITAL DATA BROADCAST ON FLIGHT TECHNICAL ERROR Final Report
Donald W. Richardson Feb. 1980 85 p refs
(Contract DOT-FA01-80-P-85745)
(AD-A085177; F-80-01; FAA/RD-80-35) Avail: NTIS HC A05/MF A01 CSCL 05/9

This report documents the data reduction and analysis of existing flight test data regarding the digital data broadcast system (DDBS) concept of automating cockpit data input procedures in an area navigation environment. Particular attention is paid to the statistical quantification of the impact of the DDBS concept on pilot steering performance, mainly flight technical error (FTE). Results of this analysis indicate that DDBS significantly reduces both pilot blunder rate and FTE, for both the enroute and approach phases of flight. GRA

N80-29046# National Technical Information Service, Springfield, Va.
PROTECTIVE CLOTHING: ARCTIC AND TROPICAL ENVIRONMENTS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1980
Edith Kenton Apr. 1980 126 p Supersedes NTIS/PS-79/0436; NTIS/PS-78/0371
(PB80-809635; NTIS/PS-79/0436; NTIS/PS-78/0371) Avail: NTIS HC $30.00/MF $30.00 CSCL 06Q

A bibliography containing 120 abstracts concerning clothing for environmental protection in extreme climates is given. Fabrics and textiles, insulating methods, physiological and psychological responses of users, mobility and dexterity of wearers, care of specialized clothing, and human factors involved are specifically addressed. GRA

N80-29047# National Technical Information Service, Springfield, Va.
PROTECTIVE CLOTHING: SURVIVAL, AIRCRAFT, AND COMBAT ENVIRONMENTS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Apr. 1980
Edith Kenton Apr. 1980 230 p Supersedes NTIS/PS-79/0438; NTIS/PS-78/0373
(PB80-809650; NTIS/PS-79/0438; NTIS/PS-78/0373) Avail: NTIS HC $30.00/MF $30.00 CSCL 06Q

A bibliography containing 224 abstracts is presented addressing the design, testing, and evaluation of protective apparel for pilots in various conditions of climate and gravity, for military personnel in combat conditions, for persons in special circumstances of exposure and survival, such as the ocean environment, and for other aviation personnel. GRA

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering.*

N80-29048*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
FUNCTIONAL SPECIFICATION OF THE PERFORMANCE MEASUREMENT (PM) MODULE
Jeffrey E. Berliner Jul. 1980 77 p refs
(Contract NAS1-15192)
(NASA-CR-159301) Avail: NTIS HC A05/MF A01 CSCL 09B

The design of the Performance Measurement Module is described with emphasis on what the PM Module would do, and what it would look like to the user. The PM Module as described could take several man-years to develop. An evolutionary approach to the implementation of the PM Module is presented which would provide an operational baseline PM Module within a few months. Author

N80-29049# Naval Postgraduate School, Monterey, Calif.
DATA BASE MANAGEMENT SYSTEM FOR MICROCOMPUTERS M.S. Thesis
Amrun Sehan and Timbul Marusp Sihombing Dec. 1979 113 p refs
(AD-A085036) Avail: NTIS HC A06/MF A01 CSCL 09/2

Many of the existing data base management systems have been developed for large applications such as big business. However other applications such as small businesses can also benefit from the managerial information which can be provided by a computer data base. This thesis develops a stand-alone data base management system using a microcomputer with floppy disk auxiliary storage and the UCSD PASCAL software package. This system has the capability to create, update, delete and insert information, and to respond to user inquiries. Because of the limited storage capacity and relatively slow access speeds of floppy disks, the system will only satisfy small applications.

However, the advent of compatible hard disk systems for microcomputers will enable the system to be used for significantly larger applications. GRA

N80-29050# Illinois Univ. at Urbana-Champaign. Coordinated Science Lab.
TEST GENERATION FOR MICROPROCESSORS Ph.D. Thesis
Satish Mukund Thatte May 1979 176 p refs
(Contracts N00014-79-C-0424; DAAB07-72-C-0259; DAAG29-78-C-0016)
(AD-A085078; R-842; UILU-ENG-78-2235) Avail: NTIS HC A09/MF A01 CSCL 09/2

The goal of this report is to develop test generation procedures for testing microprocessors in a user environment. Classical fault detection methods based on the gate and flip-flop level or on the state diagram level description of microprocessors are not suitable for test generation. The problem is further compounded by availability of a large variety of microprocessors. They differ widely in their organization, instruction repertoire, addressing modes, data storage and manipulation facilities, etc. In this report, a general graph-theoretic model for microprocessors is developed at the register transfer level. Any microprocessor can be easily modeled using information only about the instruction set and the functions performed by it. This information is easily available in the user's manual. A fault model is developed on a functional level quite independent of the implementation details. The effects of faults in the fault model are investigated at the level of the graph-theoretic model. Test generation procedures are proposed which take the microprocessor organization and the instruction set as parameters and generate tests to detect all the faults in the fault model. The complexity of the test sequences measured in terms of the number of instructions is given. Our effort in generating tests for a real microprocessor and evaluating their fault coverage is described. GRA

N80-29051# Atomic Weapons Research Establishment, Aldermaston (England).
COST EFFECTIVE MULTICHANNEL DATA LOGGING USING THE COMMODORE PET MICROCOMPUTER
J. L. Adelus London HMSO Dec. 1979 21 p ref
(AWRE-O-54/79; BR71525) Avail: NTIS HC A02/MF A01; HMSO, London £1 PHI

A multichannel data logger based on the Commodore PET microcomputer and the ADAM 12 data aquisition module was been devised. The system described incorporates 8 differential channels of 0 to 10 V each and the PET is capable of scanning these at speeds in excess of 40 channels per second when programmed in BASIC. The major hardware components are described including their electrical interconnections, and the necessary driver software. Basic component costs are listed; and compare favorably with complete systems that are commercially available. Author (ESA)

N80-29052# Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.
BASPL: A FINITE ELEMENT POSTPROCESSOR, PART 8
S. Merazzi and M. Flueck 12 Oct. 1979 39 p refs Sponsored in cooperation with EPFL Lab. d'Anal. des Contraintes 6 Vol. (Contract SWEDBESD-5061-012)
(FFA-AU-1499-Pt-8) Avail: NTIS HC A03/MF A01

A short user guide to the BASPL finite element postprocessor program is presented. The program is designed for easy postprocessing of results from nonlinear finite element analysis, such as that for wind turbine blades. The program has three main features (selective printer output, deformation shape, and flat contour) as well as a function plot. The function plot offers possibilities such as load displacement and displacement time diagrams. Author (ESA)

N80-29053# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
LINE NUMBERS MADE CHEAP
Paul Klint Jun. 1979 11 p refs Submitted for publication (MC-IW-112/79) Avail: NTIS HC A02/MF A01

A technique is described for run-time line number administration to be used for implementations of high-level languages. Under suitable circumstances, this method requires absolutely no overhead, in either time or space, during execution of the program. Author (ESA)

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-29054*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
EVALUATION OF VERIFICATION AND TESTING TOOLS FOR FORTRAN PROGRAMS
Kathryn A. Smith Jul. 1980 24 p refs
(NASA-TM-80205; L-13665) Avail: NTIS HC A02/MF A01 CSCL 09B

Two automated software verification and testing systems were developed for use in the analysis of computer programs. An evaluation of the static analyzer DAVE and the dynamic analyzer PET, which are used in the analysis of FORTRAN programs on Control Data (CDC) computers, are described. Both systems were found to be effective and complementary, and are recommended for use in testing FORTRAN programs. L.F.M.

N80-29055# Stanford Univ., Calif. Systems Optimization Lab.
THE IMPLEMENTATION OF A LAGRANGIAN-BASED ALGORITHM FOR SPARSE NONLINEAR CONSTRAINTS
B. A. Murtagh (New South Wales Univ.) and M. A. Saunders Jan. 1980 55 p refs Presented at the 10th Intern. Symp. on Mathematical Programming, Montreal, 27-31 Aug. 1979
(Contracts DAAG29-79-C-0110; DE-AS03-76SF-00326; Grants NSF MCS-76-20019; NSF ENG-77-08761)
(AD-A084825; SU-SOL-80-1; ARO-16470.9-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

An algorithm is described for solving large-scale nonlinear programs whose objective and constraint functions are smooth and continuously differentiable. The algorithm is of the augmented Lagrangian type, involving a sequence of sparse, linearly constrained subproblems whose objective functions include a modified Lagrangian term and a modified penalty function. The algorithm has been implemented in a general purpose FORTRAN code called MINOS/AUGMENTED. The system is intended for use on problems whose Jacobian matrix is sparse. (Such problems usually include a large set of purely linear constraints.) The bulk of the data may be assembled using a standard linear-programming matrix generator. Function and gradient values for all nonlinear terms are supplied by two user-written subroutines. Some aspects of the implementation are described in detail, and computational results are given for some nontrivial test problems. Assuming convergence occurs, the work involved is comparable to the solution of a moderate number of linear programs of similar size. GRA

N80-29056# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
SURFACE PERCEPTION FROM LOCAL ANALYSIS OF TEXTURE AND CONTOUR Ph.D. Thesis
Kent A. Stevens Feb. 1980 125 p refs Revised
(Contract N00014-75-C-0643; Grant NSF MCS-77-07569)
(AD-A084803; AI-TR-512-Rev) Avail: NTIS HC A06/MF A01 CSCL 06/4

The visual analysis of surface shape from texture and surface contour is treated within a computational framework. The aim of this study is to determine valid constraints that are sufficient to allow surface orientation and distance (up to a multiplicative constant) to be computed from the image of surface texture and of surface contours. The report is in three parts. Part 1 consists of a review of major theories of surface perception, a discussion of vision as computation and of the nature in which three dimensional information is manifest in the image, and a study of the representation of local surface orientation. Part 2 reconsiders the familiar (texture gradient). Part 3 examines our preception of surface contours. It is shown that surface contours are strong sources of information about local surface shape. GRA

N80-29057# Naval Postgraduate School, Monterey, Calif.
NPS-PASCAL: A MICROCOMPUTER-BASED IMPLEMENTATION OF THE PASCAL PROGRAMMING LANGUAGE M.S. Thesis
Konrad Stephen Tinius Mar. 1980 222 p refs
(AD-A085042) Avail: NTIS HC A10/MF A01 CSCL 09/2

NPS-PASCAL is a student research project at the Naval Postgraduate School, the goal of which is the implementation of the PASCAL programming language on a microcomputer system. NPS-PASCAL will consist of two programs, a compiler which produces intermediate code, and an interpreter, which will interpret the intermediate code, or a translator, which will produce target machine code. NPS-PASCAL is designed to conform to the requirements of the PASCAL Standard, as defined by the British Standards Institute/International Standards Organization Working Draft/3. The compiler program, the subject of this thesis, performs the lexical, syntactic and semantic analysis of a PASCAL program. NPS-PASCAL is written in INTEL's PL/M-80 programming language and executes on the CP/M operating system. GRA

N80-29058# Sandia Labs., Albuquerque, N. Mex.
COMPARISON OF SOFTWARE WHICH SOLVES SYSTEMS OF NONLINEAR EQUATIONS
Kathie L. Hiebert Mar. 1980 50 p refs
(Contract EY-76-C-04-0789)
(SAND-80-0181) Avail: NTIS HC A03/MF A01

Eight readily available FORTRAN codes that solve nonlinear systems of equations are compared. The eight codes are C05NAF, BRENT, HYBRD, NS01A, QN, SOSNLE, ZONE, AND ZSYSTM. General information about the codes, such as methods implemented, return criteria, calling sequence, return status information, storage requirements, print options, and other special features is included. The main emphasis of the testing is the robustness of the code. Information on the efficiency of the codes (function evaluation counts and time) is presented. The conclusions are based on the robustness of both the individual codes and the methods that they implement. The state of the art of software that solves systems of nonlinear equation (i.e., identifies areas in which the codes perform well and areas that need improving) is defined and the conclusions based on robustness and the other information (efficiency measurements, storage requirements, and special features) provide the user a guide in choosing the most appropriate code for his needs. DOE

N80-29059# Sandia Labs., Albuquerque, N. Mex. Numerical Mathematics Div.
LEAST SQUARES FITTING OF DISCRETE DATA BY POLYNOMIALS IN SEVERAL VARIABLES
Richard J. Hanson Apr. 1980 14 p refs
(Contract EY-76-C-04-0789)
(SAND-80-0197) Avail: NTIS HC A02/MF A01

The problem of least squares fitting k-dimensional data by polynomials is considered. This polynomial is represented as a linear combination of products of one dimensional Chebyschev polynomials. Suggestions about a numbering or subscripting convention are given as well as a review of appropriate solution methods for the resulting (large) least squares system. DOE

N80-29060# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Systemes et Communications.
COMPRESSION OF BINARY IMAGES BY BLOCK CODING [COMPRESSION D'IMAGES BINAIRES PAR CODAGE EN BLOC]
Joachim Woelk Jul. 1979 137 p refs In FRENCH Sponsored in part by Min. des Affaires Etrangeres de France
(ENST-D-79018) Avail: NTIS HC A07/MF A01

The suitability of different codes for the compression of high entropy black and white images (written texts, route maps, etc.) was studied. It is concluded that error correcting codes are suitable for small compressions. Transition codes are the simplest and the most promising of the codes studied. Author (ESA)

N80-29061# Fondazione Ugo Bordoni, Rome (Italy).
USE OF THE SIMULA LANGUAGE IN TELEPHONIC TRAFFIC SIMULATIONS [IMPIEGO DEL LINGUAGIO SIMULA NELLE SIMULAZIONI DI TRAFFICO TELEFONICO]
Enrico Boccalaro and Davide Grillo Nov. 1978 32 p refs In ITALIAN
(FUB-41-1978) Avail: NTIS HC A03/MF A01

The use of the SIMULA language is demonstrated by discussing its application to a telephone network model. The SIMULA component blocks, each corresponding to a different activity, are detailed. The coding requirements for the simulation of telephonic networks are discussed. It is shown that the model described by using this language is flexible and easily adaptable to the representation of complex telephonic systems. Author (ESA)

N80-29062# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
SOME ISSUES IN INTERACTIVE PROGRAMMING REVISITED
Jan vandenBos, Johan Ero, Paul tenHagen, Rens Kessener, Henk Oudshoorn, Rinus Plasmeijer, Marleen Sint, Joop vanderStar, Jan Stroet, and Arthur Veen Jul. 1979 9 p refs Submitted for publication
(MC-IW-113/79) Avail: NTIS HC A02/MF A01

Topics in the intersecting fields of graphics standards, input tools and interactive programs are discussed, and some clarifying definitions and principles developed. The recently proposed Core standard would be affected in the area of facilities for echoing, prompting and higher level input functions. Author (ESA)

N80-29063# Northeastern Forest Experiment Station, Broomall, Pa.
MISSING: A COMPUTER PROGRAM FOR THE MAXIMUM LIKELIHOOD ESTIMATES OF THE PARAMETERS OF THE MULTIVARIATE LINEAR MODEL WITH INCOMPLETE MEASUREMENTS Final Technical Report
Stanford L. Arner and Donald W. Seegrist 1980 24 p refs
(PB80-165681; ; NEFES-80-63; FSGTR-NE-56) Avail: NTIS HC A02/MF A01 CSCL 09B

A computer program that obtains maximum likelihood estimates of the parameters of a multivariate linear model in which all variates may not be measured on each experimental unit is described. The variates can be: (1) repeated measurements on the same characteristic; (2) different characteristics; or (3) a mixture of repeated measurements and different characteristics. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N80-29064# Mitre Corp., Bedford, Mass.
MODELS OF LOCAL COMPUTER NETWORKS
Carl Tropper Apr. 1980 154 p refs
(Contract F19628-79-C-0001)
(AD-A085282; MTR-3783; ESD-TR-80-111) Avail: NTIS HC A08/MF A01 CSCL 17/2

This paper presents a discussion of analytical and simulation models of locally distributed computer networks that makes use of ring or bus technology. The section of the paper devoted to ring architectures focuses on models of the Pierce, Newhall, and DLCN rings. The emphasis in the bus section of the paper is on the modeling of access protocols. GRA

N80-29065# National Technical Information Service, Springfield, Va.
AEROSPACE COMPUTER SYSTEMS: AVIONICS APPLICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Mar. 1980
Brian Carrigan May 1980 154 p Supersedes NTIS/PS-79/0313; NTIS/PS-78/0289
(PB80-810179; NTIS/PS-79/0313; NTIS/PS-78/0289) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

Studies of computer hardware and supporting software for aircraft applications are cited. The bibliography includes research on onboard data processing equipment as well as navigation and guidance computers. This updated bibliography contains

147 abstracts, 56 of which are new entries to the previous edition. GRA

N80-29066# National Technical Information Service, Springfield, Va.
AEROSPACE COMPUTER SYSTEMS: SPACE AND GUIDED MISSILES APPLICATIONS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1978 - Mar. 1980
Brian Carrigan May 1980 160 p Supersedes NTIS/PS-79/0315; NTIS/PS-78/0290
(PB80-810187; NTIS/PS-79/0315; NTIS/PS-78/0290) Avail: NTIS HC $30.00/MF $30.00 CSCL 09B

A bibliography containing 152 abstracts addressing computer hardware and supporting software for spacecraft and guided missile applications is presented. Onboard data processing equipment, telemetering data processing, and navigation and guidance computers are considered. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N80-29067*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
CONFERENCE ON AUTOMATED DECISION-MAKING AND PROBLEM SOLVING, THE THIRD DAY: ISSUES DISCUSSED
Walter W. Hawkins, Jack E. Pennington, and L. Keith Baker Jun. 1980 13 p refs Conf. held at Hampton, Va., May 1980
(NASA-TM-81846) Avail: NTIS HC A02/MF A01 CSCL 09B

A conference held at Langley Research Center in May of 1980 brought together university experts from the fields of Control Theory, Operations Research, and Artificial Intelligence to explore current research in automation from both the perspective of their own particular disciplines and from that of interdisciplinary considerations. Informal discussions from the final day of the those day conference are summarized. L.F.M.

N80-29068# Naval Postgraduate School, Monterey, Calif.
DIFFUSION APPROXIMATIONS FOR THE COOPERATIVE SERVICE OF VOICE DATA MESSAGES M.S. Thesis
J. P. Lehoczky and D. P. Gaver Feb. 1980 42 p refs
(AD-A085126; NPS55-80-007) Avail: NTIS HC A03/MF A01 CSCL 17/2

A probability model is presented for a set of communication channels that share the service of data and voice transmissions. A diffusion-theoretic approximation is derived, utilizing new results of Burman (1979). It is shown that the data queue (which is of low priority relative to voice) is approximated by a Wiener process. GRA

N80-29069# Illinois Univ. at Urbana-Champaign. Decision and Control Lab.
DESIGN OF OPTIMAL SYSTEMS WITH LOW SENSITIVITY TO SMALL TIME DELAYS Ph.D. Thesis
Mahmoud El-Sayed Sawan Jun. 1979 112 p refs
(Contract N00014-79-C-0424; Grant AF-AFOSR-3633-78)
(AD-A085076; DC-27; UILU-ENG-78-2239; R-846) Avail: NTIS HC A06/MF A01 CSCL 12/1

The work in this thesis is an addition to the study of trajectory sensitivity of optimal control systems. The parameter with respect to which sensitivity is studied is a small undesirable time delay that might occur in a system designed nominally with zero delays. A design strategy is proposed to guarantee low sensitivity of optimal control systems. A numerical algorithm is presented to solve the resulting necessary conditions of optimality. It is applied to a practical example. Encouraging results are obtained. GRA

N80-29070# Illinois Univ. at Urbana-Champaign. Decision and Control Lab.
OUTPUT FEEDBACK POLE-PLACEMENT IN THE DESIGN OF COMPENSATORS FOR SUBOPTIMAL LINEAR QUADRATIC REGULATORS M.S. Thesis
William Edward Hopkins, Jr. Jun. 1979 143 p refs
(Contracts N00014-79-C-0424; EX-76-C-01-2088; Grant AF-AFOSR-3633-78)
(AD-A085075; DC-847; UILU-ENG-78-2240; R-847) Avail: NTIS HC A07/MF A01 CSCL 09/3

Based on a modified output regulator problem, a design oriented methodology is presented for the construction of output feedback compensators retaining L(1 < or = 1 < or = n) optimal eigenvectors from a reference state feedback regulator. Viewing L as a design parameter, it is known that in the case L = r this requires a dynamic compensator of dimension L-r whose parameters are determined in function of the solution of an associated output feedback pole-placement problem. Using an iterative dyadic pole-placement procedure, an algorithm is given which determines the solution of this pole-placement problem without a priori assumptions on the compensator dimension. The methodology is also extended to the class of stabilizable systems and the required compensator is shown to possess a separation property. Finally the design methodology is illustrated by three nontrivial examples. GRA

N80-29071# Illinois Univ. at Urbana-Champaign. Decision and Control Lab.
DECOMPOSITION OF TIME-SCALES IN LINEAR SYSTEMS USING DOMINANT EIGENSPACE POWER INTERACTIONS AND MATCHED ASYMPTOTIC EXPANSIONS
R. G. Phillips and P. V. Kokotovic Oct. 1979 121 p refs
(Contract N00014-79-C-0424; Grant AF-AFOSR-3633-78)
(AD-A085260; DC-31; R-861; UILU-ENG-78-2254) Avail: NTIS HC A06/MF A01 CSCL 12/1

Many control theory concepts are valid for any system order, however, their actual use is limited to low order models. Large scale systems result not only in a formidable amount of computation, but also in ill-conditioned initial and two point boundary value problems. The interaction of fast and slow phenomena in high order systems results in stiff numerical problems which require expensive integration routines. The singular perturbations approach to decomposing fast ad slow phenomena involves using a time-scale separation technique. In this case, a reduced order 'steady state' and 'boundary layer' solutions are obtained from a high order model. Control designs and simulations for the high order model are then carried out on the reduced order subsystems. GRA

N80-29072# Illinois Univ. at Urbana-Champaign. Decision and Control Lab.
DECENTRALIZED CONTROL AND MULTICRITERION DECISION MAKING Ph.D. Thesis
Peter Michael Walsh Dec. 1979 93 p refs
(Contract DAAG29-78-C-0016; N00014-79-C-0424)
(AD-A085205; DC-32; UILU-ENG-78-2258; R-865) Avail: NTIS HC A05/MF A01 CSCL 12/1

This report examines issues arising from the presence of conflicting goals among decentralized controllers. Of primary interest is the role that the Stackelberg strategy can play in the decentralized control problem. A sampled data Stackelberg coordination scheme is developed in which both conceptual and computational issues are dealt with. Conditions which are sufficient for guaranteeing the existence of a stabilizing Stackelberg equilibrium solution are derived for a simple form of the Stackelberg strategy. Also, the role that the information structure can play in the decentralized control problem is demonstrated and a form of the Stackelberg strategy is developed for designing improved information structures. GRA

N80-29073# Oak Ridge National Lab., Tenn. Chemistry Div.
PROGRAMMING METHODOLOGY OF ARTIFICIAL INTELLIGENCE
Carroll K. Johnson 1980 16 p refs Presented at the Intern. Winter School on Crystallographic Computing, Bangalore, India, 4 Jan. 1980
(Contract W-7405-eng-26)
(CONF-800122-1) Avail: NTIS HC A02/MF A01

Some of the non-numerical methods developed in the branch of computer science known as artificial intelligence (AI) were designed specifically for the task of encoding empirical rules of good judgment into a form suitable for machine reasoning. The production-rule technique, one of the principal AI programming

techniques currently used in the knowledge engineering area of AI is summarized. An illustrative application involving the interpretation of protein electron-density maps is also described. DOE

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-29074*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE UNIQUE DETERMINATION OF DENSITY FROM HIGH-ORDER POTENTIALS
G. G. Johnson Aug. 1980 23 p refs
(NASA-TM-81031; JSC-16771; Rept-80-FM-42) Avail: NTIS HC A02/MF A01 CSCL 12A

The existence of higher-order potentials is postulated, and that the density function can be determined from this set of potentials is demonstrated. Moreover, it is shown that there is a one-to-one correspondence between such potentials and the density function, provided it is continuous. Finally, it is noted that this demonstration includes a method of constructing the density function from the set of potentials as well as indicating how to approximate the density from incomplete knowledge of the potentials. F.O.S.

N80-29075*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SMOOTHING FILTERS
William H. Lear Jul. 1980 58 p
(NASA-TM-81033; JSC-16700; Rept-80-FM-32) Avail: NTIS HC A04/MF A01 CSCL 12A

The improvement of accuracy in using the smoothing filter instead of the Kalman filter is discussed. Factors of improvement for velocity errors of up to four are shown for position measurements. Smoothing equations are presented, and it is shown that smoothing equations for the smoothing filter appear to be stable. F.O.S.

N80-29076# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
MINIMUM DISTANCE AND ROBUST ESTIMATION
William C. Parr and William R. Schucany 5 Oct. 1979 42 p refs
(Contract N00014-75-C-0439)
(AD-A085183; TR-136) Avail: NTIS HC A03/MF A01 CSCL 12/1

Robust and consistent of the location parameter of an asymmetric distribution and general, non-location and scale parameter estimation problems have been vexing problems in the history of robustness studies. The minimum distance (MD) estimation method is shown to provide a heuristically reasonable mode of attack for these problems which also leads to excellent robustness properties. Both asymptotic and Monte Carlo results for the familiar case of estimation of the location parameter of a symmetric distribution support this proposition, showing MD-estimators to be competitive with some of the better estimators thus far proposed. GRA

N80-29077# Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, Md.
A COMPUTER PROGRAM FOR ESTIMATION OF THE WEIBULL INTENSITY FUNCTION AND FOR THE CRAMER-VON MISES GOODNESS OF FIT TEST, REVISED
Edward F. Belbot Apr. 1980 71 p refs Revised
(DA Proj. 1R7-65706-M-541)
(AD-A085112; AMSAA-TR-279-Rev) Avail: NTIS HC A04/MF A01 CSCL 12/1

This report describes the structure and use of a digital computer program written in Standard FORTRAN, which can be used to obtain the maximum likelihood estimates of the parameters of the Weibull intensity function. The program also performs the Cramer-Von Mises goodness of fit test. GRA

N80-29078# Center for Naval Analyses, Alexandria, Va. Operations Evaluation Group.
THE LAGUERRE TRANSFORM
J. Kielson (Rochester Univ.), W. Nunn, and U. Sumita (Rochester Univ.) May 1980 125 p refs
(AD-A085100; OEG-PP-2B4) Avail: NTIS HC A06/MF A01 CSCL 12/1

A novel transform is presented which maps continuum functions (such as probability distributions) into discrete sequences and permits rapid numerical calculation of convolutions, multiple convolutions, and Neumann expansions for Volterra integral equations. The transform is based on the Laguerre polynomials, associated Laguerre functions, and their convolution properties. Part 1 of this paper deals with functions having support only on (0 infinity). The resulting unilateral Laguerre transform finds applications in convolution of such functions, inversion of Laplace transform, and in solution to renewal and related Volterra integral equations. Part 2 of this paper deals with functions having support on (-infinity, infinity) via a bilateral Laguerre transform which is an extension of the unilateral transform. Applications of this technique include convolution of such functions and analysis of the Lindley process. Part 1 has been published in Applied Mathematics and Computation and part 2 has been submitted for publication in that journal. GRA

N80-29079# Florida State Univ., Tallahassee.
CALCULATION OF STATE PROBABILITIES FOR A STOCHASTIC LANCHESTER COMBAT MODEL
L. Billard Nov. 1979 34 p refs
(Contract N62271-79-M-2395)
(AD-A085125; NPS55-79-029) Avail: NTIS HC A03/MF A01 CSCL 12/1

Lanchester (1914) presented his original combat model between two forces in a deterministic framework. Here, it is shown how the underlying state probabilities of a stochastic analogue of Lanchester's model can be calculated. GRA

N80-29080# Naval Postgraduate School, Monterey, Calif.
A FREQUENCY DOMAIN ANALYSIS OF THE LINEAR DISCRETE KALMAN FILTER M.S. Thesis
Walter Jeremiah Costello Mar. 1980 100 p refs
(AD-A085058) Avail: NTIS HC A05/MF A01 CSCL 12/2

The linear discrete Kalman filter was analyzed using a frequency domain approach. Process and measurement noise covariances are shown to be critical design parameters which, together with the assumed prior state and covariance estimates, completely determine the gain schedule of the linear Kalman filter. Several relevant design techniques are illustrated and discussed. The concepts of smoothing and sharpening are demonstrated. Extensions to adaptive, non-linear, and non-parametric filtering are briefly discussed, as are applications to inventory management, estimation of time varying mean functions, and multiple regression. GRA

N80-29081# Illinois Univ. at Urbana-Champaign. Applied Computation Theory Group.
NEW RESULTS ON PLANAR TRIANGUALTIONS M.S. Thesis
Peter D. Gilbert Jul. 1979 49 p refs
(Contracts N00014-79-C-0424; DAAB07-72-C-0259; DAAG-29-78-C-0016; Grant NSF-MCS76-17321)
(AD-A085016; ACT-15; UILU-ENG-78-2243) Avail: NTIS HC A03/MF A01 CSCL 12/1

Several new results in planar triangulations are presented. In particular, an O(N sq log N) time worst-case algorithm for the construction of the 'greedy' triangulation is presented, an improvement over the previously best-known construction in time O(N cu). The minimum weight triangulation (MWT) of a simple N-vertex polygon is shown to be constructible in time O(N cu). A local property of MWTs is proved, a side result of which is that the shortest edge between a pair of points must be in a MWT. Also, it is shown that the Delaunay Triangulation is not 'approximately optimal', and that the ratio of the total length of the Delaunay Triangulation of N points to that of the MWT can be large as roughly N/2. GRA

N80-29082# Argonne National Lab., Ill. Applied Mathematics Div.

TOWARDS SENSIBLE FLOATING-POINT ARITHMETIC
W. J. Cody 1980 8 p *refs Presented at COMPCON, San* Francisco, 25 Feb. 1980
(Contract W-31-109-eng-38)
(CONF-800201-7) Avail: NTIS HC A02/MF A01

Efforts to promote the development of high-quality transportable numerical software show that few, if any, of the floating-point *arithmetic systems in existing computers are completely* satisfactory for serious numerical computation. Examination of the defects in these systems leads to specifications for a sensible floating-point system from a numerical analyst's viewpoint. DOE

N80-29083# California Univ., Livermore. Lawrence Livermore Lab.
GEARS: A PACKAGE FOR THE SOLUTION OF SPARSE, *STIFF ORDINARY DIFFERENTIAL EQUATIONS*
Andrew H. Sherman (Toronto Univ.) and Alan C. Hindmarsh Mar. 1980 12 p refs Presented at SIAM Intern. Conf. on Elec. Power *Problems: The Mathematical Challenge, Seattle,* 18-20 Mar. 1980
(Contract W-7405-eng-48)
(UCRL-84102; CONF-800334-1) Avail: NTIS HC A02/MF A01

A package of FORTRAN subroutines designed to solve stiff systems of ordinary differential equations of the form $dy/dt = f(y,t)$, where the Jacobian matrices are large and sparse is described. *The integrator is based on the stiffly stable methods* due to GEAR, and this approach leads to a sparse system of nonlinear equations at each time step. These are solved with a *modified Newton iteration, using one of two separate sparse* matrix packages to solve the sparse linear equations that arise. Issues that affected the design of the package, and a numerical example to *illustrate the effectiveness of the package are* included. DOE

N80-29084# California Univ., Livermore. Lawrence Livermore Lab.
USE OF A *GENERAL NONLINEAR LEAST-SQUARES CURVE* FITTING PROGRAM WITH NONCLOSED FORM RELATIONSHIPS
A. E. Abey 26 Dec. 1979 23 p *ref*
(Contract W-7405-eng-48)
(UCID-18506) Avail: NTIS HC A02/MF A01

A use for GNLS, a general nonlinear least-squares curve fitting program, is presented. In this use, GNLS determines a set of best parameters for relationships that cannot be written in closed form. This program can be useful for experimenters who need to determine experimental parameters by fitting *nonclosed-form relationships to experimental data. Two examples* are given to indicate how GNLS can be used for this type of problem. DOE

N80-29085# California Univ., Livermore. Lawrence Livermore Lab.
COMPARISON OF SEVERAL CONSERVATIVE FORMS FOR FINITE ELEMENT FORMULATIONS
Robert L. Lee, Philip M. Gresho, Steven T. Chan, and Robert L. Sani (NOAA, Boulder, Colo.) Oct. 1979 12 p refs Presented at 3d Intern. Conf. on Finite Element in Flow Problems, Banff, Alberta, 10-13 Jun. 1980
(Contract W-7405-eng-48)
(UCRL-82868; CONF-800613-2) Avail: NTIS HC A02/MF A01

Why the advective form for the primitive variable formulation of the inviscid Boussinesq (or Navier-Stokes) equations is nonconservative and how several potentially useful conservative formulations can be generated is demonstrated. Several forms are considered which conserve the following quantitites individually or in combinations: total energy, temperature (enthalpy), temperature squared, or none of the above (advective form). Finally the numerical performance and stability of these various formulations are compared via numerical solutions of the time dependent, inviscid equations of motion employing the finite element method. DOE

N80-29086# Centre de Recherches Scientifiques et Techniques de l'Industrie des Fabrications Metalliques, Brussels (Belgium). Construction Metallique Section.
INTRODUCTION TO THE BOUNDARY INTEGRAL EQUATION METHOD
Rudy Beeckman Dec. 1979 29 p refs Presented at Seminar on Machine Mech., Ghent Sponsored by Inst. pour l'Encouragement de la Rech. Sci. dans l'Ind. et l'Agr. (IRSIA)
(CRIF-MT-133) Avail: NTIS HC A03/MF A01

The mathematical background for the boundary integral equation method and its situation among other methods of (numerical) analysis is summarized. The method is discussed with respect to its application to the classical problem of the equilibrium of an isotropic elastic body. R.C.T.

N80-29087# National Technical Information Service, Springfield, Va.
WALSH FUNCTIONS. CITATIONS FROM THE NTIS DATA BASE *Progress Report, 1964 - Apr. 1980*
Brian Carrigan May 1980 115 p Supersedes NTIS/PS-79/0539; NTIS/PS-78/0508
(PB80-810385; NTIS/PS-79/0539; NTIS/PS-78/0508) Avail: NTIS HC $30.00/MF $30.00 CSCL 09D

A bibliography containing 107 abstracts is presented addressing multidisciplinary applications of Walsh functions in signal processing. Emphasis is placed on the use of Walsh functions in information theory, pattern recognition, image processing, data processing, and data transmission. The necessary software and numerical analysis are cited. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-29088*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CYCLES TILL FAILURE OF SILVER-ZINC CELLS WITH COMPLETING *FAILURES MODES: PRELIMINARY DATA* ANALYSIS
Steven M. Sidik, Harold F. Leibecki, and John M. Bozek 1980 48 p *refs Presented at Ann. Meeting of the Am. Statist.* Assoc., Houston, Tex., 11-14 Aug. 1980
(NASA-TM-81556; E-517) Avail: NTIS HC A03/MF A01 CSCL 14D

One hundred and twenty nine cells were run through *charge-discharge cycles until failure. The experiment design was* a variant of a central composite factorial in five factors. Preliminary data analysis consisted of response surface estimation of life. Batteries fail under two basic modes: a low voltage condition and an internal shorting condition. A competing failure modes analysis using maximum likelihood estimation for the extreme value life distribution was performed. Extensive diagnostics such as residual plotting and probability plotting were employed to verify data quality and choice of model. Auhtor

N80-29089# Princeton Univ., N. J. Dept. of Statistics.
A BIWEIGHT APPROACH TO THE ONE-SAMPLE PROLEM
Karen Kafadar Nov. 1979 39 p refs
(Grant DAAG29-76-G-0298)
(AD-A084817; TR-151-SER-2; ARO-14244.11-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

A (t)-like statistic, replacing the classical mean by a biweight in the numerator and the sample variance by a corresponding variance term in the denominator that modifies that used by Gross is proposed and evaluated for its efficiency in constructing confidence intervals in stretched-tailed situations. For the case of many samples of common population width, the method of borrowing estimates of the variance of the numerator via root-mean-squares is considered. The one-sample bi-weight-(t) is shown, via Monte Carlo simulations, to be very efficient for samples of moderate sizes (in terms of expected length of the confidence interval), and combining variance estimates in the denominator is useful when the underlying distribution of the sample is not extremely long-tailed. GRA

N80-29090# Florida State Univ., Tallahassee. Dept. of Statistics.
EXTREME POINTS OF THE CLASS OF DISCRETE DECREAS-

ING FAILURE RATE AVERAGE LIFE DISTRIBUTIONS
Naftali A. Langberg, Ramon V. Leon, James Lynch, and Frank Proschan Apr. 1980 15 p refs
(Contract DAAG29-79-C-0158; Grant AF-AFOSR-3678-78)
(AD-A084798; FSU-Statistics-M541; ARO-16773.11-M; ARO-TR-D-46) Avail: NTIS HC A02/MF A01 CSCL 12/1

It is shown that the class of discrete decreasing failure rate average (discrete DFRA) life distributions is a convex set. The extreme points of this class are then obtained. Finally this report shows how to represent any discrete DFRA life distribution as a mixture of these extreme points. GRA

N80-29091# Naval Postgraduate School, Monterey, Calif.
AN EXAMINATION OF THE PERFORMANCE OF TWO ACCEPTANCE DECISION RULES FOR CURTAILED WALD SEQUENCE SAMPLING PLANS M.S. Thesis
Bambang Murgiyanto Mar. 1980 64 p refs
(AD-A085059) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper examines the implications on acceptance sampling decisions when the Wald Sequential Probability Ratio (SPR) Sampling process is curtailed. Two procedures are proposed to determine the stopping rules. The first procedure uses the scope of the least-square fitted line compared with the slope of the boundary lines of a Wald SPR Sampling Plan. The second procedure uses the relative position of the last observation between the rejection acceptance lines to determine the stopping rules. Computer programs are used to simulate the sampling process, proving estimates of operating characteristic points. GRA

N80-29092# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France). Div. Systemes Balistiques et Spatiaux.
RAPID ESTIMATION OF THE THREE PARAMETERS OF A WEIBULL LAW [ESTIMATION RAPIDE DES TROIS PARAMETRES D'UNE LOI DE WEIBULL]
Robert Attuly and Christian Bertin Paris 1979 30 p In FRENCH Presented at 37th Tech. Meeting of Avionics Panel on Avionics Reliability, its Tech. and Related Disciplines, Ankara, 9-13 Apr. 1979
(SNIAS-792-422-113) Avail: NTIS HC A03/MF A01

The estimation of the three parameters of the Weibull law is a delicate operation especially with small samples. The maximum likelihood method leads to a system of equations requiring extensive calculations. The saturation method proposed employs the quasi-exhaustivity of a small amount of data associated with the sample and provides results similar to those obtained with the maximum likelihood method. It has however the following advantages: ease of use (graphical or analytical procedures), the sample size is taken into consideration, and only results related to the sample are stored in a memory. The considerations developed lead to a tetra-parametric law by simultaneously generalizing the Weibull Gamma and normal laws. Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-29093# Naval Postgraduate School, Monterey, Calif.
REPRESENTATION OF DISCRETE OPTIMIZATION PROBLEMS BY DISCRETE DYNAMICS PROGRAMS
Douglas R. Smith Feb. 1980 31 p refs
(RR00001101)
(AD-A085062; NPS52-80-004) Avail: NTIS HC A03/MF A01 CSCL 12/1

This paper investigates the conditions under which a discrete optimization problem can be formulated as a dynamic program. Following the terminology of (Karp and Held 1967), a discrete optimization problem is formalized as a discrete decision problem and the class of dynamic programs is formalized as a sequential decision process. Necessary and sufficient conditions for the representation in two different senses of a discrete decision problem by a sequential decision process are established. In the first sense (a strong representation), the set of all optimal solutions to the discrete optimization problem is obtainable from the solution of the functional equations of dynamic programming. In the second sense (a weak representation), a nonempty subset of optimal solutions is obtainable from the solution of the functional equations of dynamic programming. It is shown that the well known principle of optimality corresponds to a strong representation. A more general version of the principle of optimality is given which corresponds to a weak representation of a discrete decision problem by a sequential decision process. We also show that the class of strongly representable discrete decision problems is equivalent to the class of sequential decision processes which have cost functions satisfying a strict monotonicity condition. Also a new derivation is given of the result that the class of weakly representable discrete decision problems is equivalent to the class of sequential decision processes which have a cost function satisfying a monotonicity condition. GRA

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-29094# California Univ., Los Angeles. Dept. of System Science.
THE STABILITY AND STABILIZABILITY OF INFINITE DIMENSIONAL LINEAR SYSTEMS VIA LIAPUNOV'S DIRECT METHOD Ph.D. Thesis
Alan Paul Ross Jul. 1979 114 p refs
(Grants AF-AFOSR-0053-79; NSF ENG-75-11879; AF Proj. 2304)
(AD-A085299; UCLA-ENG-8005; AFOSR-80-0439TR) Avail: NTIS HC A06/MF A01 CSCL 12/1

This dissertation attempts to extend to infinite dimensional linear systems in a Hilbert space some of the stability and stabilizability results that have been obtained for finite dimensional systems using the direct method of Liapunov. The familiar finite dimensional applications of Liapunov's direct method to the stability and stabilizability of linear systems involve the existence of certain positive matrices which satisfy some form of algebraic Riccati equation. Former extensions of these results to infinite dimensional systems in Hilbert space apply exclusively to exponential (uniform asymptotic) stability. Recently, recognizing that exponential stability is a very strong property to expect of some physical systems, some attention has been paid to weaker forms of stability. This thesis generalizes the results of Liapunov's direct method to infinite dimensional systems in a manner that addresses these weaker forms of stability. This is accomplished by developing the distinct concepts of nonnegative, positive, and strictly positive operators. The resulting stability and stabilizability theorems are stated in terms of weak stability, but they are shown to be applicable, in many cases, to strong and exponential stability as well. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-29095*# DyTec Engineering, Inc., Long Beach, Calif.
ATMOSPHERIC TURBULENCE EFFECTS ON AIRCRAFT NOISE PROPAGATION
Robert L. Chapkis Jun. 1979 55 p refs
(Contract NAS1-15321)
(NASA-CR-159325; DyTec-7924) Avail: NTIS HC A04/MF A01 CSCL 20A

The Brown and Clifford model for the apparent sound attenuation cussed by atmospheric turbulence was reviewed and extended. Calculations, based on the model, were made for the predicted sound attenuation for a tower-mounted loudspeaker-type sound source and for an airplane sound source. The important parameters in the model are identified and discussed. A model for sound fluctuations is also presented and a practical experimental program to validate the models described. A.R.H.

N80-29096*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE ELEVENTH ANNUAL PRECISE

TIME AND TIME INTERVAL (PTTI) APPLICATION AND PLANNING MEETING
Schuyler C. Wardrip, ed. 1979 703 p refs Meeting held in Greenbelt, Md., 27-29 Nov. 1979; sponsored by NASA, Goddard Space Flight Center, Naval Electronics Systems Command, Naval Research Lab., Naval Observatory, and Defense Communications Agency
(NASA-CP-2129) Avail: NTIS HC A99/MF A01 CSCL 14B

Thirty eight papers are presented addressing various aspects of precise time and time interval applications. Areas discussed include: past accomplishments; state of the art systems; new and useful applications, procedures, and techniques; and fruitful directions for research efforts. For individual titles, see N80-29097 through N80-29131.

N80-29097*# Defense Communications Engineering Center, Reston, Va.
SUGGESTED ATTRIBUTES FOR TIMING IN A DIGITAL DCS
Harris A. Stover *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 15-29 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A set of suggested attributes for a timing capability for the Defense Communication System which must be capable of supporting full-scale warfare in addition to peacetime needs are presented. Reasons for each attribute are given. R.E.S.

N80-29098*# National Bureau of Standards, Boulder, Colo. Frequency and Time Standards Group.
IMPACT OF IMPROVED CLOCKS AND OSCILLATORS ON COMMUNICATIONS AND NAVIGATION SYSTEMS Special Report
Samuel R. Stein *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 31-39 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A technology assessment of independent precision clocks and oscillators, which are one way of obtaining timing information in distributed systems, is presented. The reliability of the clocks is discussed along with the problem areas which are affecting research and development. Problem areas discussed include: device specifications, production costs, standards, and the use of custom made devices. R.E.S.

N80-29099*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE TIME TRANSFER VIA TDRSS AND APPLICATIONS
Andrew R. Chi *In its* Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 45-64 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The satellite time transfer terminal design concept for the Tracking and Data Relay Satellite System (TDRSS) and the application of the time signal in autonomously operated spacecraft clock are presented. Some pertinent TDRSS parameters and corrections for the propagation delay measurement as well as the time code used to transfer the time signal are given. R.E.S.

N80-29100*# Naval Research Lab., Washington, D. C.
TIMING AND FREQUENCY CONSIDERATIONS IN THE WORLDWIDE TESTING OF A SPREAD SPECTRUM COMMUNICATION SYSTEM
D. G. Woodring, Stephen A. Nichols, and Roger Swanson (AFAL, Wright-Patterson AFB, Ohio) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 65-78 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

During 1978 and 1979, an Air Force C-135 test aircraft was flown to various locations in the North and South Atlantic and Pacific Oceans for satellite communications experiments. A part of the equipment tested on the aircraft was the SEACOM spread spectrum modem. The SEACOM modem operated at X band frequency from the aircraft via the DSCS II satellite to a ground station. For data to be phased successfully, it was necessary to maintain independent time and frequency accuracy over relatively long periods of time (up to two weeks) on the aircraft and at the ground station. To achieve this goal, two Efratom atomic frequency standards were used. The performance of these frequency standards as used in the spread spectrum modem is discussed, including the effects of high relative velocity, synchronization and the effects of the frequency standards on data performance is discussed. The aircraft environment, which includes extremes of temperature, as well as long periods of shutdown followed by rapid warmup requirements, is also discussed. R.E.S.

N80-29101*# National Bureau of Standards, Boulder, Colo.
LIMITATIONS ON LONG-TERM STABILITY AND ACCURACY IN ATOMIC CLOCKS
David J. Wineland *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 81-112 refs Sponsored in part by AFOSR (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The limits to accuracy and long term stability in present atomic clocks are examined. Recent proposals for new frequency standards are discussed along with the advantages and disadvantages of frequency standards based on such ideas as laser transitions, single atoms, and atom cooling. The applicability of some of these new techniques to existing standards is examined. R.E.S.

N80-29102*# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
THE PERFORMANCE OF PRIMARY Cs BEAM CLOCKS USING QUADRUPOLE AND HEXAPOLE DEFLECTION SYSTEMS. CONSEQUENCES FOR TIME KEEPING
Gerhard Becker *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 113-143 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Since 1978 the time-and-frequency standard CS1 of the Physikalisch-Technische Bundesanstalt (PTB) has operated continuously as a 'primary clock'. Its uncertainty (7.1 to the negative 15th power) is considerably smaller than that of the other existing primary standards. The CS1 is equipped with a combination of quadrupole and hexapole magnets and uses a longitudinal C-field. Consequences of utilizing primary clocks of this quality for the generation of the International Atomic Time Scale TAI are discussed. Author

N80-29103*# European Space Agency, Toulouse (France).
THE LASSO EXPERIMENT
Bernard Serene (CNES, Toulouse, France) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 145-170 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

An international coordinated experimental assessment of a system which promises to provide a synchronization of clocks bound to time and frequency standard laboratories, with an accuracy of one nanosecond using existing or near ground-based laser stations via a geostationary satellite (SIRIO-2) is detailed. The system performance and the technical details concerning the on-board equiment, the ground segment, and the operational configuration are discussed. Finally, the future prospects of the LASSO experiment and possible implementations are examined together. M.G.

N80-29104*# National Bureau of Standards, Boulder, Colo.
SOME IMPLICATIONS OF RECIPROCITY FOR TWO-WAY CLOCK SYNCHRONIZATION
James L. Jespersen *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 171-184 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The difficulties related to propagation perturbances in one-way and two-way methods for the synchronization of remote clocks are defined, and a possible means of circumventing these problems

in the two-way method is suggested. In the two-way method, if signals are launched from two sources, A and B, then the two signals arriving at A and B will be displaced in arrival time by an amount that is equal to the difference in launch times of the two signals. Thus, the only condition to comparing clocks is that the medium be isotropic. The practice implementation of this is explored theoretically, in some detail, with respect to the Loran-C navigation system. M.G.

N80-29105*# Bureau International de l'Heure, Paris (France).
EVOLUTION OF THE INTERNATIONAL ATOMIC TIME TAI COMPUTATION
Michel Granveaud *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 185-196 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The computation of the International Atomic Time (TAI), a worldwide time reference, is briefly examined. The types of atomic clocks, computation procedures, and time intercomparison between clocks utilizing navigation satellites are addressed. Changes in the system would essentially depend on the improvement of the atomic clocks. M.G.

N80-29106*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HYDROGEN MASER IMPLEMENTATION IN THE DEEP SPACE NETWORK AT THE JET PROPULSION LABORATORY
Paul F. Kuhnle *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 197-210 (For primary document see N80-29096 19-70)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 14B

The Frequency Standard Test Laboratory and its activities are described. The test laboratory has the capability to measure the frequency stability of five frequency standards including environmental parameters. Nine frequency standards may be evaluated simultaneously upon completion of the current instrumentation expansion program. Frequency stability measurements and environmental data on five H-masers are presented. M.G.

N80-29107*# Naval Observatory, Washington, D. C.
TIME DISSEMINATION: AN UPDATE
Kenneth Putkovich *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 213-233 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A brief description of some of the improvements in the generation and dissemination of precise time and time interval at the U.S. Naval Observation are described. Details on some of the newer hardware developed for this purpose are presented. Data from tests of two of the more significant items, a small portable clock with performance approaching that of larger units and a GPS Time Transfer Unit capable of time transfer to an accuracy of less than 100 nanoseconds, are also given. M.G.

N80-29108*# Defense Mapping Agency Hydrographic and Topographic Center, Washington, D.C.
TIME TRANSFER WITH THE NAVSTAR GLOBAL POSITIONING SYSTEM
Ben D. Roth, William Klepczynski (Naval Observatory), and R. Glen Hall (Naval Observatory) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 235-254 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The NAVSTAR global positioning system (GPS) was evaluated and tested in terms of performance. A variety of operational and technical issues were addressed which characterize the performance of the system. The precision and accuracy of the transfer of GPS time to the static user were measured and a base of information was developed that would support and expedite efforts to develop and evaluate specialized user equipment to exhibit the operational GPS's precision timing characteristics. R.C.T.

N80-29109*# Naval Research Lab., Washington, D. C.
PRECISE TIME AND TIME INTERVAL (PTTI) MEASUREMENTS FROM THE NAVIGATION TECHNOLOGY SATELLITES AND THE GPS NAVSTAR-4 SATELLITE
James A. Buisson, Thomas McCaskill, B., O. Jay Oaks, M. M. Jeffries, and S. B. Stebbins *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 255-281 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A time domain estimate for the NAVSTAR-4 SV clock offset was obtained for each SV pass over the GPS monitor sites, using a smoothed reference ephemeris, with corrections for ionospheric delay, tropospheric delay, earth rotation and relativistic effects. Conversion from the time domain to the frequency domain was made using the two sample Allan Variance; sigma-tau plots used to identify the noise processes. Estimates of flicker and white frequency noise for the NAVSTAR-4 rubidium frequency standard were obtained. The contribution of the reference ground clocks and other error sources to the frequency stability estimates were also considered. R.C.T.

N80-29110*# National Bureau of Standards, Boulder, Colo.
TIME RECOVERY MEASUREMENTS USING OPERATIONAL GOES AND TRANSIT SATELLITES
Roger E. Beehler, D. D. Davis, J. V. Cateora, A. J. Clements, J. A. Barnes, and E. Mendez-Quinones *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 283-312 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Results of regular monitoring of both the GOES and TRANSIT timing signals over a number of months at the National Bureau of Standards (NBS), Boulder, Colorado are presented. The TRANSIT results include an analysis of how received timing accuracy and stability are affected by: (1) averaging over varying numbers of satellite passes; (2) averaging over different combinations of the five available satellites; (3) using several independent receivers of the same type; and (4) application of published corrections to the received data. Based on monitoring experience to date at NBS, some pros and cons of using each of the available operational systems are discussed. Updated information on recent improvements incorporated into the GOES time code generation and monitoring system at Wallops Island, Virginia is also included. E.D.K.

N80-29111*# Radio Research Labs., Tokyo (Japan).
T AND F COMPARISONS VIA BROADCASTING SATELLITE AND NAVIGATION TECHNOLOGY SATELLITE
Y. Saburi, Yoshiyuki Yasuda, S. Kobayashi, and T. Sato *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 315-328 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The preliminary time/frequency dissemination experiments were made using the BSE. In order to establish the technique of the doppler shift canceling, the phase control servo including the satellite link and the precompensating frequency control using the measured values or using the orbital data of the satellite are tested. The amount of the residual doppler shift at the control station can be reduced to the order of 1 part in 10 to the 12th power or less by use of the first and the second methods. The method using the orbit data is expected to give a control capability of a few parts in 10 to 11th power. Thus, the maximum value of the doppler shift at the farther most place of the country is estimated to be + or - 2 x 10 to the -10 power without any correction. The experiment of the international time comparison via the NTS 1 was made for about one year since October 1978. The data of time difference between UTC(USNO) and UTC(RRL) are in good agreement with those via the portable clock of the USNO. By applying the correction for ionospheric delay the standard deviation of the data can be reduced to about one-half. E.D.K.

N80-29112*# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
ONE WAY TIME TRANSFER VIA METEOSAT CAPABLE OF 30 ns ACCURACY
Klemens Nottarp, Wolfgang Schluster, and Udo Hustbnar (Physik. Tech. Bundesanstalt, Brunswick, West Germany) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 329-342 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The METEOSAT ranging signal's available every 3 hours for about 1.5 minutes, its phase is measured against the second pulses of the station clocks. A system study shows that the accuracy obtainable could be in the order of 30 ns. The receiver unit consists of a 2 m diameter fixed antenna, a low noise broadband receiver, and a phase tracker and demodulator. The overall costs will be less than $20,000 US. E.D.K.

N80-29113*# Institut de Recherche de l'Hydro-Quebec, Varennes.
TIME DISSEMINATION IN THE HYDRO QUEBEC NETWORK
G. Missout, Warren LeFrancois, and Louis LaRoche *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 343-350 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The ever increasing complexity of electrical networks combined with the increasing cost of power losses during a network failure has led public utilities to become equipped with more powerful and precise tools for pinpointing the causes of such a fault. Hydro Quebec has developed and is now using a time dissemination system which uses a modified IRIG B code transmitted on its own telecommunication network. The reasons for using such a system and the way it was carried out are discrete. Author

N80-29114*# Istituto Elettrotecnico Nazionale, Torino (Italy).
TIME CODED DISTRIBUTION VIA BROADCASTING STATIONS
S. Leschiutta, V. Pettiti, and E. Detoma (Bendix Field Engineering Corp., Columbia, Md.) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 351-361 Sponsored by the Consiglio Nazl. delle Ric. Italy (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The distribution of standard time signals via AM and FM broadcasting stations presents the distinct advantages to offer a wide area coverage and to allow the use of inexpensive receivers, but the signals are radiated a limited number of times per day, are not usually available during the night, and no full and automatic synchronization of a remote clock is possible. As an attempt to overcome some of these problems, a time coded signal with a complete date information is diffused by the IEN via the national broadcasting networks in Italy. These signals are radiated by some 120 AM and about 3000 FM and TV transmitters around the country. In such a way, a time ordered system with an accuracy of a couple of milliseconds is easily achieved. Author

N80-29115*# National Bureau of Standards, Boulder, Colo.
VOICE ANNOUNCEMENTS OF TIME: A NEW APPROACH
J. Jespersen, G. Kamas, and M. Weiss *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 363-384 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A technique for generating voice time announcements was investigated. Equipment to convert time codes from several different sources into voice announcements was developed. The major emphasis was directed toward demonstrating the technical feasibility of the approach as well as cost effective implementation. R.C.T.

N80-29116*# National Physical Lab., New Delhi (India).
A STUDY OF TIME DISSEMINATION VIA SATELLITE IN INDIA
B. S. Mathur, P. Banerjee, P. C. Sood, Mithlesh Saxena, Nand Kumar, A. K. Suri, C. L. Jain (Space Applications Centre, Ahmedabad, India), and K. Kumar (Space Applications Centre, Ahmedabad, India) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 387-402 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A simultaneous two way clock synchronization experiment between three Earth stations, was performed and improvements over the technique earlier attempted in which transmit/receive roles of the two stations were alternated at regular intervals, were studied. Time signals via two modes high frequency and satellite were critically monitored and analyzed. This time format was modified to include the additional information about time of the day in year, month, day, hour, minute and second as well as DUT1 in BCD code and was disseminated via the satellite. These signals were decoded, displayed and studied. Some preliminary work on time transfer via TV using direct satellite broadcast, was also conducted. R.C.T.

N80-29117*# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
ADVANCES IN THE STABILITY OF HIGH PRECISION CRYSTAL RESONATORS
Arthur Ballato and John R. Vig *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 403-440 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Advances in technology directed toward minimizing the temporal changes in frequency of crystal resonators are described. Specific emphasis is placed on reducing their susceptibility to temperature, acceleration, and other environmental effects. R.C.T.

N80-29118*# Frequency Electronics, Inc., New Hyde Park, N.Y.
GALILEO QUARTZ CLOCK
Martin Block, Marvin Meirs, M. Rosenfeld, and Peter C. Garriga (Hughes Aircraft Co., El Segundo, Calif.) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 441-455 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A quartz oscillator for use in the Galileo experiment (orbiter and Probe) for Jupiter mission 1982 are described. This oscillator has achieved significant performance breakthroughs by the use of an SC cut, double rotated, crystal in a titanium dewar flask. Some of the performance parameters as well as the design feature of the oscillator are presented. R.C.T.

N80-29119*# Ecole Nationale Superieure de Mecanique et des Microtechniques, Besancon (France).
INITIAL RESULTS ON 5 MHz QUARTZ OSCILLATORS EQUIPPED WITH BVA RESONATORS
Raymond J. Besson and Donald A. Emmons (Frequency and Time Systems, Inc., Danvers, Mass.) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 457-469 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The techniques of fabricating BVA resonators are discussed in terms of aging, amplitude-frequency effect, and acceleration sensitivity. Results on 5 MHz resonators concerning aging versus drive level, reduced amplitude-frequency effect, frequency and phase stability performance, and frequency retrace following power interruption are presented. It is indicated that a zero aging rate is possible at a drive level which depends on the qaurtz material used. For natural AT quartz, a level of 70 to 90 micro W appears to be optimum, and for SC quartz approximately 160 micro W. R.C.T.

N80-29120*# Naval Research Lab., Washington, D. C. E. O. Hulbert Center for Space Research.
TIME TRANSFER VIA SATELLITE-LINK RADIO INTERFEROMETRY
Stephen H. Knowles, W. B. Waltman, J. L. Yen (Toronto Univ.),

W. H. Cannon (York Univ., Toronto), W. Petrachenko (York Univ., Toronto), N. W. Broten (National Research Council, Ottawa), C. Costain (National Research Council, Ottawa), D. H. Fort (National Research Council, Ottawa), J. A. Galt (National Research Council, Penticton), J. A. Popelar (Dept. of Energy, Mines and Resources, Ottawa) et al *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 471-481 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Very long baseline interferometry using natural radio sources was investigated as a possible time transfer method. Antennas were linked using a synchronous communications satellite instead of the customary independent frequency standards and tape recorders. A successful preliminary time transfer was performed using a wideband data link that was accurate at the 100 nanosecond level, and frequency standards were compared to a part in 10 to the minus thirteenth power over a 24 hour period using a phase coherent satellite link. The narrow band phase coherent link method is potentially capable of timing accuracy of 10 picoseconds, and frequency comparison accuracy of 10 to the minus sixteenth power, and is in addition economical of spectrum usage. R.C.T.

N80-29121*# National Service of Metrology, Delft (Netherlands).
COMPARISON OF DIFFERENT TIME SYNCHRONIZATION TECHNIQUES
Robert Kaarls and G. deJong *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 485-498 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The plans to set up an international TV synchronization network between four locations are discussed. A feasibility study was conducted between two of the locations and significant results are reported. R.C.T.

N80-29122*# National Research Council of Canada, Ottawa (Ontario).
TWO-WAY TIME TRANSFER VIA GEOSTATIONARY SATELLITES NRC/NBS, NRC/USNO AND NBS/USNO VIA HERMES AND NRC/LPTF (FRANCE) VIA SYMPHONIE
C. C. Costain, J. S. Boulanger, H. Daams, D. W. Hanson (NBS, Boulder), Roger E. Beehler (NBS, Boulder), A. J. Clemets (NBS, Boulder), D. D. Davis (NBS, Boulder), W. J. Klepczynski (USNO, Washington, D.C.), Lester B. Veenstra (COMSAT Labs., Clarksburg, Md.), and J. Kaiser (COMSAT Labs., Clarksburg, Md.) *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

In most of the experiments, 1 pps pulses of the station atomic clocks were exchanged between the partners, and a cubic equation was fitted to the 1000 to 2000 second measurements. The equations were exchanged and substracted to obtain the time difference of the stations. The standard deviation in the fit of the equations varied, depending on conditions, from 1.5 ns to 16 ns. For the last month of the Hermes experiment, a 1 MHz signal was used, giving a standard deviation of 0.18 ns. The comparison of the time scales via satellite and via Loran-C (BIH Circular D) show clearly that some Loran-C links are very good, but that the NBS link varies by 1 micron s. Via the satellite the frequencies of the time scales can be compared with an accuracy of 2 x 10 to the minus 14 power. A.R.H.

N80-29123*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SIRIO-1 TIMING EXPERIMENT
E. Detoma and S. Leschiutta (Istituto Elettrotecnico Nazionale 'G. Ferraris', Torino, Italy) *In its* Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 521-556 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

A time synchronization experiment was performed between two ground stations located in the northern and in the central part of Italy. The rf communication channels used are in the SHF region, with the uplink carrier at 18 GHz and the downlink at 12 GHz. One way and two way techniques were evaluated. Two modes of operation were tested in the two way technique: sequential, time multiplexed, signal transmission on the same communication channel; and simultaneous transmission using separate communication channel. In the sequential mode of operation, range and doppler measurements provided by the timing signals were used to account for the satellite motion. A low cost, versatile, time transfer unit (TTU) was designed, to generate the timing signals and the functions (RF carrier and receiver switching, time tagging of the data, etc.) required to perform automatic time synchronization and data acquisition with a minimum of external components. A.R.H.

N80-29124*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Communications Systems Research Section.
DEMONSTRATION OF REMOTE CLOCK MONITORING BY VLBI WITH THREE BASELINE CLOSURES
Craig M. Cheetham, W. J. Hurd, J. W. Layland, George A. Madrid, and Thomas P. Yunck *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 557-576 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

The capability of very long baseline interferometry (VLBI) to monitor the stability of remotely located hydrogen maser frequency standards has been demonstrated by a series of experiments conducted between Deep Space Stations in Australia, Spain, and California. The measured stabilities of the clock systems, over approximately 10 day intervals, were 1 to 3 parts in 10 to the 13th power, with the instabilities due to the oscillators, the clock distribution systems, the receiving system delays, and the VLBI measurement error. Experiments were conducted independently using two different systems (BLOCK 0 and WBDAS). Later comparison shows agreement on the order of 1 part in 10 to the 13th power. Closure was demonstrated on three separate occasions to 33, 10, and 13 ns with an error uncertainty of + or - 42 ns. The results represent an important consistency check on VLBI measurements. A.R.H.

N80-29125*# Jet Propulsion Lab., La Canada, Calif.
TRAVELING CLOCK VERIFICATION OF VLBI SYNCHRONIZATION
Larry E. Young *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 577-583 ref (For primary document see N80-29096 19-70)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 14B

Four experiments are described which involved measurements of clock offsets at two DSN stations. Both VLBI and traveling clock measurements were performed and the agreement between the two methods was within about 6 ns for all four comparisons. Author

N80-29126*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EARLY RESULTS FROM A PROTOTYPE VLBI CLOCK MONITORING SYSTEM
Thomas P. Yunck and George A. Madrid *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 585-598 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Four sets of experiments were conducted to measure the relative epoch offsets between atomic clocks in California, Australia, and Spain by means of very long baseline interferometry (VLBI). The experiments were conducted using an incomplete R & D VLBI system with a number of inherent limitations. The results indicate that the measurement objective of epoch offset to 10 nanoseconds will be met. Tables show the measured offset, the residual to fit, and the square root Allan variance. Graphs show the rate change and the rate reset. A.R.H.

N80-29127*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SOURCE STRUCTURE ERRORS IN THE SYNCHRONIZATION OF CLOCKS BY RADIO INTERFEROMETRY
J. B. Thomas *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl.

and Planning Meeting 1979 p 599-616 (For primary document see N80-29096 19-70)
(Contract NAS7-100)
Avail: NTIS HC A99/MF A01 CSCL 14B

Radio interferometry has the potential of synchronizing clocks across intercontinental distances with accuracies better than one nanosecond. One of the potential error sources in such determinations is the spatial structure of the natural radio sources that provide the reference signals. Due to their extent, the effective position of these sources can vary as a function of the length and orientation of the baseline vector joining the two antennas. If they are not corrected, such variations can lead to errors in clock synchronization. The theory of structure corrections is presented and specific examples are given to illustrate the nature and size of the effect. A.R.H.

N80-29128*# National Bureau of Standards, Boulder, Colo.
PROSPECTS FOR ADVANCES IN MICROWAVE ATOMIC FREQUENCY STANDARDS
Fred L. Walls *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 618-648 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Traditional standards based on rubidium, cesium and hydrogen have been greatly refined over the past decade, such that the frequency stability of the current generation of devices is generally limited by those basic concepts on which they are based. Future advances in frequency stability will principally come from changes in the concepts on which the standards are based, and only secondarily from more careful engineering of the old concepts. The fundamental limitations in these standards are considered and the important conceptual and component advances which could have a major impact on future performance of these standards are indicated. A very promising new class of microwave standards based on ion storage techniques is examined. A.R.H.

N80-29129*# Frequency and Time Systems, Inc., Danvers, Mass.
CLOCK PERFORMANCE, RELIABILITY AND COST INTERRELATIONSHIPS
Martin W. Levine *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 643-655 refs (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Problems encountered by clock manufacturers in attempting to supply reasonably priced, reliable clocks for critical aerospace applications arise from the inherent technical difficulties of designing and fabricating equipment to provide performance at the limits of the state of the art in demanding environments. The difficulties are compounded by inconsistent and unstandardized specification practices, and by an emphasis on initial acquisition costs, rather than on life cycle costs. Conventional parts stress analyses, which do not provide a useful indication of the reliability of a clock, lead to increased parts costs for high performance aerospace clocks without comensurate benefits in improved reliability or performance. The characterization of clocks in terms of the mean time between resynchronizations, facilitates the estimation of life cycle costs and provides a means to evaluate clocks in a realistic fashion for specific systems applications. A.R.H.

N80-29130*# Beijing Inst. of Radio Metrology and Measurements (China).
THE FREQUENCY AND TIME STANDARD AND ACTIVITIES AT THE BEIJING INSTITUTE OF RADIO METROLOGY AND MEASUREMENTS
Hong-Tang Wang *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 657-683 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Three kinds of frequency measuring systems are described: frequency comperison, phase comparison, and time comparison. With the help of the portable cesium clock in determining the time delay between two stations, a time synchronization, experiment was conducted using the Symphonie satellite. A result with an accuracy of 30 ns and an uncertainty of about 10 ns was obtained. Another experiment, applying the television pulse technique for time synchronization, yielded a result with an error of about 0.5 mu s in 24 hours. In order to measure the short term frequency stability of crystal oscillators or other frequency sources, a rubidium maser atomic frequency standard was developed as well as a short term stability measuring system. A.R.H.

N80-29131*# National Inst. of Metrology, Beijing (China).
RECENT PROGRESS OF THE RESEARCH WORK ON FREQUENCY AND TIME AT THE NIM
Huang Bingying *In* NASA. Goddard Space Flight Center Proc. of the 11th Ann. Precise Time and Time Interval (PTTI) Appl. and Planning Meeting 1979 p 685-688 (For primary document see N80-29096 19-70)
Avail: NTIS HC A99/MF A01 CSCL 14B

Chinese activities reported include (1) research and development on the primary cesium beam standard and the high precision crystal oscillator; (2) keeping the atomic time and calibrating frequency standards; (3) determining methods for transferring the standard frequency at the highest precision. The primary beam installation gives an accuracy of 1.2 x 10 to the minus 12 power (1 sigma). Improvements are being made to attain an uncertainity goal of the order of 10 to the minus 13 power. Two experiments conducted are described. One involved standard frequency transfer via TV color subcarrier; the other involved time synchronization via Symphonie satellite. The best results are the random fluctuation of direct measurement data is 1 sigma sub r (RMS) < 10 ns, and the absolute error of clock synchronization is 1 sigma sub A (RMS) < 30 ns. A.R.H.

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-29132*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
PREDICTION OF UNSUPPRESSED JET ENGINE EXHAUST NOISE IN FLIGHT FROM STATIC DATA
James R. Stone 1980 26 p refs Presented at 6th Aeroacoustics Conf., Hartford, Conn., 4-6 Jun. 1980; sponsored by AIAA
(NASA-TM-81537; E-491) Avail: NTIS HC A03/MF A01 CSCL 20A

A methodology developed for predicting in-flight exhaust noise from static data is presented and compared with experimental data for several unsuppressed turbojet engines. For each engine, static data over a range of jet velocities are compared with the predicted jet mixing noise and shock-cell noise. The static engine noise over and above the jet and shock noises is identified as excess noise. The excess noise data are then empirically correlated to smooth the spectral and directivity relations and account for variations in test conditions. This excess noise is then projected to flight based on the assumption that the only effects of flight are a Doppler frequency shift and a level change given by 40 log (1 - m sub 0 cos theta), where M sub 0 is the flight Mach number and theta is the observer angle relative to the jet axis. M.G.

N80-29133*# National Aeronautics and Space Administration, Washington, D. C.
RESEARCH: AIRCRAFT NOISE REDUCTION IN FRANCE
Marc Pianko Jun. 1980 17 p refs Transl. into ENGLISH from Voies-Avaition Civile (France), 1979 p 31-34 Original language document was announced as A80-21962 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-75832) Avail: NTIS HC A02/MF A01 CSCL 20A

In 1967 the French aeronautics industry began extensive research in the field of noise abatement. Substantial progress is shown for both supersonic and subsonic transports as well as for helicopters. L.F.M.

N80-29134# Pennsylvania State Univ., University Park. Applied Research Lab.
AN EXPERIMENTAL ANALYSIS OF THE BASIC PHENOMENA INVOLVED IN MODERN DIFFRACTION THEORIES Ph.D. Thesis
Mark Stiles Lang 21 Jan. 1980 454 p refs
(Contract N00024-79-C-6043)
(AD-A084937; ARL-PSU-TM-80-43) Avail: NTIS HC A20/MF A01 CSCL 20/1

This study utilizes direct experimental techniques to analyze the basic scattering mechanisms that are important to modern diffraction theories. The efforts are intended to supplement and guide the development of theoretical models by exploring parameter ranges and configurations that are intuitive extensions of the cases handled by current prediction techniques. A broad program of experimental investigation of rigid three dimensional scatterers is presented. The thin prolate spheroids is used as a basic model for scattering from smoothly curved bodies. Baffles, cylinders, cones, and cone variants serve for an examination of edges and tips of various orders. In addition to standard pulse measurements with gated receivers, some data are obtained by a holographic imaging technique. The results show that the backscattered pressure from smoothly curved bodies is determined almost exclusively by specular effects, even at wavelengths that are relatively large compared to the appropriate dimensions of the scatterers. Small changes in or additions to the smooth surface, however, modify both the amplitude and directivity of the scattering. The Freedman theory of echo formation is carefully derived, and its predictions are compared with applicable experimental results. GRA

N80-29135# Texas Univ. at Austin. Applied Research Labs.
CHARACTERISTICS OF THE ARL:UT MOVING SOURCE VERTICAL LINE ARRAY PROPAGATION MODEL (OBERON)
Terry L. Foreman and Susan G. Payne 5 Mar. 1980 37 p refs
(Contract N00014-78-C-0329)
(AD-A084824; ARL-TM-80-5) Avail: NTIS HC A03/MF A01 CSCL 20/1

This report describes a moving source vertical line array model based on normal mode theory. A stationary vertical line array consisting of omnidirectional receiver elements is insonified by a point time harmonic source moving with constant speed and direction. The acoustic field generated by the source is computed using normal mode theory with Doppler corrections. The computer model computes beam spectra and features array steering, shading, and Doppler effects such as line shifting and broadening. GRA

N80-29136# Georgetown Univ., Washington, D.C. Dept. of Physics.
NONSPECULAR ULTRASONIC EFFECTS FOR LAYERED MEDIA AND SECOND HARMONICS IN LAMB WAVES Technical Report, 16 Jul. 1979 - 1 Apr. 1980
Neal G. Brower, Douglas Himberger, J. A. McClure, Walter G. Mayer, K. W. Ng, and D. K. Ngoc Apr. 1980 36 p refs
(Contract N00014-78-C-0584)
(AD-A084964; GUUS-04802; TR-2) Avail: NTIS HC A03/MF A01 CSCL 20/1

Theoretical and experimental evidence is given to explain reflectivity and transmissivity of bounded ultrasonic beams impinging on flat solid thin and thick plates immersed in water. Effects are described which have to be considered when high amplitude ultrasonics is used or when the liquid-solid combination differs significantly from the usual metal-water combination of reflecting media. GRA

N80-29137# Illinois Univ. at Urbana-Champaign.
THEORY OF GUIDED ACOUSTIC WAVES IN PIEZOELECTRIC CRYSTALS
Supriyo Datta Jul. 1979 82 p refs
(Contracts DAAG29-78-C-0016; N00014-79-C-0424)
(AD-A085035; R-849; UILU-ENG-78-2242) Avail: NTIS HC A05/MF A01 CSCL 20/1

A non-iterative variational technique for solving the acoustic field equations is applied to three different boundary conditions, namely, a free surface, an edge and a surface with periodic discontinuities. A perturbation approach to surface wave scattering by periodic discontinuities is also developed and used to obtain both the elastic and the piezoelectric scatter matrix of a single electrode in a periodic array directly from the material parameters of the substrate and the electrodes. This scatter matrix accurately predicts the response of surface wave filters, transducers and reflectors. GRA

N80-29138# Research Inst. of National Defence, Stockholm (Sweden).
THE IMPORTANCE OF THE TRANSMISSION CAPACITY OF THE SEA IN HYDROACOUSTIC SYSTEM DESIGN. PART A: UNDERWATER COMMUNICATION [BETYDELSEN AV HAVETS TRANSMISSIONSEGENSKAPER VID KONSTRUKTION AV HYDROAKUSTIKA SYSTEM. A: UNDERVATTENSKOMMUNIKATION]
Tore Pentelius Oct. 1979 29 p refs In SWEDISH
(FOA-C-30167-E2) Avail: NTIS HC A03/MF A01

The classical theory of wave transmission is discussed as it applies to the design of hydroacoustic systems. Time and frequency variability are studied using the concept of point scattering, and with a model of a communication channel. The properties of scattering functions are analyzed in the context of diversity. A model system using actual data is described. Errors, coding considerations, and civilian applications are mentioned.
Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-29139 California Univ., Berkeley.
SINGLE ELECTRON ATTACHMENT AND STRIPPING CROSS SECTIONS FOR RELATIVISTIC HEAVY IONS Ph.D. Thesis
Henry Joseph Crawford 1979 88 p
Avail: Univ. Microfilms Order No. 8014841

The results of a Bevalac experiment to measure the single electron attachment and stripping cross sections for relativistic (0.5 < beta < 0.95)C, Ne, and Ar ions passing through thin solid targets ranging in atomic number from 4(Be) to 79(Au) are reported. Magnetic analysis was used to separate the single electron, N sub 1, and fully stripped, N sub 0, ion beams emerging from the targets. Separate counters measured the number of ions in each charge state. The ratios N sub 1/N sub 0 for different target thicknesses were fit to a simple growth curve to yield electron attachment and stripping cross sections. The data are compared to relativistic extrapolations of available theories. Clear evidence for two separate attachment processes, radiative and non-radiative, is found. Data are compared to a recently improved formulation for the stripping cross sections.
Dissert. Abstr.

N80-29140# Washington Univ., Seattle. Dept. of Physics.
COHERENT SPECTROSCOPY ON SINGLE ATOMIC SYSTEM AT REST IN FREE SPACE, NO. 3 Annual Report, 1 Aug. 1979 - 31 Jul. 1980
Hans Dehmelt Apr. 1980 8 p
(Contract N00014-77-C-0556; Grant NSF PHY-78-08562; NR Proj. 407-003)
(AD-A084395; AR-3) Avail: NTIS HC A02/MF A01 CSCL 07/4

Electric resonances from three isotopes of the Mg- ion stored in a miniaturized Paul rf trap have now been observed. The feasibility of our laser fluorescence observation and cooling schemes has been demonstrated on the Ba- and mono-ion oscillator thereby cooled to << 0.1 K. GRA

N80-29141# Georgia State Univ., Atlanta.
THEORETICAL STUDIES OF THE INTERACTION OF RADIATION WITH MATTER Final Report, 1 Sep. 1974 - 31 Dec. 1979
Steven T. Manson 29 Feb. 1980 13 p refs
(Grants DAHC04-74-G-0217; DAAG29-77-G-0063)
(AD-A084911; ARO-1132.14-P; ARO-14560.6-P) Avail: NTIS

HC A02/MF A01 CSCL 07/4

Work on the interaction of radiation with matter is described. In particular photoabsorption by ions and excited states is discussed, along with positive ion properties. Born approximation results for EDST charged particle impact ionization of atoms. The relevance of these areas to various applied areas such as radiation protection and safety, X-ray laser schemes and effects, nuclear pumped lasers, and IR detection is pointed out. GRA

N80-29142# California Univ., Berkeley. Lawrence Berkeley Lab.

HEAVY ION COLLISIONS

Philip J. Siemens Dec. 1979 38 p refs Presented at Intern. Conf. on High Energy Phys. and Nucl. Struct., Vancouver, Canada, 13 Aug. 1979 Submitted for publication

(Contract W-7405-eng-48)

(LBL-9595; CONF-790847-17) Avail: NTIS HC A03/MF A01

The status of research into collisions of nuclei at high energy is reviewed. Reactions and products are classified, spectator matter is discussed and then the thermalization of participant matter is considered at some length. Finally, disintegration of the hot matter is addressed. A = 20 and 40 projectiles of 250 to 1050 MeV/A are employed to illustrate the major points. DOE

N80-29143# Kansas State Univ., Manhattan. Dept. of Physics.

ELECTRON TRANSFER IN ION-ATOM COLLISIONS

C. D. Lin 1979 8 p refs Presented at 5th Intern. Seminar on Ion-Atom Collisions, Tokai-Mura, Japan, 6-7 Sep. 1979 Sponsored in part by Alfred P. Sloan Foundation

(Contract DE-AC02-79ER-10514)

(COO-10514-2; CONF-790950-3) Avail: NTIS HC A02/MF A01

Theoretical development in the understanding of electron transfer processes is reviewed. K-K electron transfer processes are studied for projectiles (nuclear charge Z/sub B/) and targets (nuclear charge Z/sub A/) in which Z/sub A/ and Z/sub B/ range from Z/sub A/ much greater than Z sub/ B/ to Z/sub A/ approximately Z/sub B/, over the energy range $0.1 < v/v_e < 2$. DOE

N80-29144# California Univ., Livermore. Lawrence Livermore Lab.

THEORY OF ATOMIC MOTION IN RESONANT RADIATION Ph.D. Thesis

Richard Joseph Cook Mar. 1980 138 p refs

(Contract W-7405-eng-48)

(UCRL-52925) Avail: NTIS HC A07/MF A01

Atomic motion in resonant and near resonant electromagnetic radiation was investigated theoretically beginning with atomic motion in a resonant standing light wave and isotope separation by selective photodeflection. The Schroedinger equation for atomic motion in a resonant standing wave was solved in the limit of short atom-field interaction time. It is shown that (1) momentum transfer from the field to the atom in a standing wave proceeds at the rate of induced absorption-emission processes rather than at the spontaneous rate characteristic of momentum transfer in a plane running wave, (2) a narrow beam of two level atoms is split by the amplitude gradient of a resonant electromagnetic wave; and (3) an exact solution to the Schroedinger equation for atomic motion in a resonant standing wave can be written in terms of Mathieu functions. Ehrenfest-Bloch formalism is generalized to take account of laser phase fluctuations and the associated finite linewidth of laser radiation and the influence on atomic motion of quantum-mechanical fluctuations of the radiation force is investigated. DOE

N80-29145# Los Alamos Scientific Lab., N. Mex.

***ELECTRON EXCITATION COLLISION STRENGTHS FOR* POSITIVE ATOMIC IONS: A COLLECTION OF THEORETICAL DATA**

A. L. Merts, J. B. Mann, W. D. Robb, and N. H. Magee Mar. 1980 227 p refs

(Contract W-7405-eng-36)

(LA-8267-MS) Avail: NTIS HC A11/MF A01

Data on theoretical and experimental cross sections for electron impact excitation of positive atomic ions are presented to update and correct a preliminary manuscript which was used during an Atomic Data Workshop on Electron Excitation of Ions held at Los Alamos in November 1978. The current status of quantitative knowledge of collisional excitation collision strengths is shown for highly stripped ions where configuration mixing, relativistic and resonance effects may be important. The results show a reasonably satisfactory state for first row isoelectronic ions and indicate that a considerable amount of work remains to be done for second row and heavier ions. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-29146# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.

WAVE-PARTICLE INTERACTIONS ON RELATIVISTIC ELECTRON BEAMS Summary Report, 31 Dec. 1971 - 1 Jun. 1980

Ira B. Bernstein and Jay L. Hirshfield 16 May 1980 4 p ref

(Contract N00014-79-C-0588; NR Proj. 020-043)

(AD-A085055; Rept-2) Avail: NTIS HC A02/MF A01 CSCL 20/9

Summaries are provided on the following topics: Linearized Theory including Axial Magnetic Field; Non-Linear Theory; Quasi-Linear Theory; and Single Particle Theory for Free Electron Laser with a Strong Axial Field. GRA

N80-29147# Ballistic Research Labs., Aberdeen Proving Ground, Md.

PROFILE: A GENERAL CODE FOR FITTING ION BEAM ANALYSIS SPECTRA

A. Niller, R. Birkmire, and J. Gerrits Apr. 1980 60 p refs

(DA Proj. 1L1-61102-AH-43)

(AD-A084984; AD-E430441; ARBRL-TR-02233) Avail: NTIS HC A04/MF A01 CSCL 09/2

A general program for analyzing energy distributions of particles scattered in ion beam experiments has been developed. This program uses numerical integration methods to model elastic scattering and nuclear reaction spectra from known cross sections, energy loss data and assumed depth concentration profiles of surface constituents. Direct comparison of the predicted and experimental distributions yields detailed, quantitative information about these depth concentration profiles in a complicated surface. The program is capable of analyzing all hydrogen or helium ion elastically scattered distributions and the (d,p) nuclear reaction peaks due to carbon, nitrogen, and oxygen. Analysis of the elemental concentration profiles of the surfaces of three different samples is discussed. GRA

N80-29148# Spire Corp., Bedford, Mass.

DIELECTRIC GUIDE CONTROLLED COLLECTIVE ION *ACCELERATION Final Report*

Kirtland AFB, N. Mex. AFWL Feb. 1980 52 p refs

(Contract F29601-77-C-0081; AF Proj. 2301)

(AD-A084994; AD-E200467; FR-60015; AFWL-TR-77-248) Avail: NTIS HC A04/MF A01 CSCL 20/7

Experiments performed at Spire and NRL have demonstrated dielectric guide controlled collective ion acceleration. Control of the phenomenon has been established by varying the electron beam parameters or guide geometry. Specifically, it has been shown that: total electron current must exceed the space charge limit; increasing electron current density increases the ion energy; a minimum electron current density is required; increasing guide length (assuming the electron beam can propagate to the end) increases ion energy; increasing guide radius at constant electron current decreases ion energy; and, the energy or charge deposited per unit area of wall controls the velocity of propagation of the electron beam front and therefore the energy of the ions. NRL VEBA results showed that: dielectric guide controlled collective ion acceleration is

effective at higher electron beam energies; an electron beam with current pinched on axis is more efficient for ion acceleration; and melding the surface of the guide can control the beam front velocity. GRA

N80-29149# Battelle Memorial Inst., Columbus, Ohio. Office of Nuclear Waste Isolation.

WASTE ISOLATION PERFORMANCE ASSESSMENT: A STATUS REPORT

H. C. Burkholder Nov. 1979 31 p refs

(Contract EY-76-C-06-1830)

(ONWI-60) Avail: NTIS HC A03/MF A01

The assessment of system performance following emplacement of the waste is a key activity in the development of nuclear waste isolation systems. The assessment results provide a technical basis for decisions concerning site selection, repository design selection, engineered barrier selection, and system acceptability, and they bear directly on the central issue of nuclear waste isolation: Do the proposed isolation systems sufficiently protect humans from the waste. The performance assessment problem, general approaches to its solution, and the status of the development, validation, and application of performance assessment technology are described. DOE

N80-29150# Battelle Pacific Northwest Labs., Richland, Wash. Ecological Sciences Dept.

RADIOLOGICAL ASPECTS OF SEA BED DUMPING IN THE *DEEP OCEANS*

W. L. Templeton 1979 19 p refs Presented at 3rd NEA Seminar on Marine Radioecology, Tokyo, 1-5 Oct. 1979

(Contract EY-76-C-06-1830)

(PNL-SA-8011; CONF-791050-2) Avail: NTIS HC A02/MF A01

A recent radiological assessment of the dumping of packaged radioactive wastes on the seabed is discussed and some environmental aspects of the United States Department of Energy program are described. The feasibility of the emplacement of contained radioactive wastes within the deep ocean sediments is examined. DOE

N80-29151# Hanford Engineering Development Lab., Richland, Wash.

ROLE OF SPENT FUEL CHARACTERIZATION IN THE DEVELOPMENT OF SAFE REPOSITORIES

R. L. Fish, R. S. Davis, and D. A. Cantley Aug. 1979 25 p Presented at the 1st Ann. ONWI Inform. Meeting, Columbus, Ohio, Oct. 1979

(Contract EY-76-C-14-2170)

(HEDL-SA-1890-FP; CONF-791033-8) Avail: NTIS HC A02/MF A01

Destructive and nondestructive testing methods for characterizing spent nuclear fuels are briefly described. Incorporation of these descriptions into the more comprehensive spent fuel performance prediction model aids in the overall licensing of repositories for permanent disposal of the spent fuel waste form. DOE

N80-29152# Los Alamos Scientific Lab., N. Mex.

***GENERAL-PURPOSE HEAT SOURCE PROJECT AND SPACE NUCLEAR SAFETY AND FUELS PROGRAM* Progress Report, Jan. 1980**

W. J. Maraman, comp. Apr. 1980 25 p

(Contract W-7405-eng-36)

(LA-8311-PR) Avail: NTIS HC A02/MF A01

Results from continuing investigations related to the use of 238PuO2 in radioisotopic power systems are reported. The two programs involved are the general purpose heat source development and space nuclear safety and fuels. A flow apparatus was constructed and used to measure the permeation of air through the fine-weave, pierced fabric 3D graphite. Results show that the graphite does not appear to provide a major barrier to the flow of air into the interior of the heat source module. Results from terrestrial and aquatic environmental tests are also given. M.G.

N80-29153# Brookhaven National Lab., Upton, N. Y.

NONLINEAR INTERACTION OF COLLIDING BEAMS IN PARTICLE STORAGE RINGS

J. C. Herrera and M. Month 1979 23 p Presented at Intern. Conf. on Nonlinear Dyn., New York, 17-21 Dec. 1979

(Contract EY-76-C-02-0016)

(BNL-27390; CONF-791240-1) Avail: NTIS HC A02/MF A01

When two beams of high energy particles moving in opposite directions are brought into collision, a large amount of energy is available for the production of new particles. However, to obtain a sufficiently high event rate for rare processes, such as the production of the intermediate vector boson large beam currents are also required. Under this circumstance, the high charge density of one beam results in a classical electromagnetic interaction on the particles in the other beam. This very nonlinear space charge force, called the beam-beam force, limits the total circulating charge and, thereby, the ultimate performance of the colliding ring system. The basic nature of the beam-beam force is discussed, indicating how it is quite different in the case of continuous beams, which cross each other at an angle as compared to the case of bunched beams which collide head-on. Some experimental observations on the beam-beam interaction in proton-proton and electron-positron beams are reviewed and interpreted. DOE

N80-29154# Nebraska Univ., Lincoln. Dept. of Chemistry.

***HIGH ENERGY HALOGEN ATOM REACTIONS ACTIVATED BY NUCLEAR TRANSFORMATIONS* Progress Report, 15 Feb. 1979 - 14 Feb. 1980**

Edward P. Rack Feb. 1980 41 p refs

(Contract EY-76-S-02-1617)

(COO-1617-63) Avail: NTIS HC A03/MF A01

High energy reactions of halogen atoms or ions, activated by nuclear transformations, are studied in gaseous, high pressure, and condensed phase saturated and unsaturated hydrocarbons, halomethanes and other organic systems. Results in six areas of investigation are discussed including: (1) reactions of iodine with alkenes and alkynes activated by radiative neutron capture and isomeric transition in low pressure gaseous systems; (2) the gas-to-condensed phase transition in halogen high energy chemistry; (3) systematics of halogen hot atom reactions; (4) mathematical and computer simulation studies of caging events within an ice lattice are being investigated; (5) cyclotron-produced chlorine and fluorine hot atoms substitution reactions with molecules possessing a single chiral center; and (6) the applications of high energy techniques and concepts to neutron activation analysis for trace elements and trace molecule determinations in biological systems. DOE

N80-29155# Battelle Memorial Inst., Columbus, Ohio. Office of Nuclear Waste Isolation.

DISPOSAL OF SPENT NUCLEAR FUEL

Dec. 1979 72 p refs

(Contract EY-76-C-06-1830)

(ONWI-59) Avail: NTIS HC A04/MF A01

The mined geologic disposal of spent nuclear fuel from Pressurized Water Reactors and Boiling Water Reactors is addressed. Although some fuel processing options are identified, the isolation of spent fuel in the form in which it is removed from the reactor is emphasized. The characteristics of the waste management system and research which relate to spent fuel isolation are discussed. The differences between spent fuel and processed high level wastes which impact the waste isolation system are defined and evaluated for the nature and extent of that impact. Other waste forms and programs such as geologic exploration, site characterization, and licensing which are generic to all waste forms are also discussed. All evidence to date indicates that there is no reason, based on safety considerations, that spent fuel should not be disposed of as a waste. DOE

N80-29156# National Academy of Engineering, Washington, D. C.

***THE OUTLOOK FOR NUCLEAR POWER* Final Report**

David L. Bazelon, Harvey Brooks, Earnest F. Gloyna, Wolf Hafele, and Willis M. Hawkins Nov. 1979 81 p refs Presented at the Tech. Sess. of the Ann. Meeting of the Natl. Acad. Eng., Washington, D.C., 1 Nov. 1979

(PB80-175755; NAE-AMTS-1979; LC-80-80730; ISBN-0-309-03039-0) Avail: NTIS HC A05/MF A01 CSCL 18I

Papers by authors from backgrounds in law, the aerospace industry, energy modeling, and engineering, focusing on several aspects of nuclear power attempt to present a balanced assessment of nuclear power and its role in the nation's energy future. Topics covered are: need for nuclear power worldwide including risks and benefits; technological improvements in the operation, safety, and reliability of nuclear power facilities; comparison to space program experience and commercial aircraft experience; problem of nuclear waste management; and projections of future world energy supply and demand and the role of nuclear power. GRA

74 OPTICS

Includes light phenomena.

N80-29157*# Hughes Research Labs., Malibu, Calif.
INTEGRATED OPTIC WAVEGUIDE DEVICES Final Report
O. Glenn Ramer May 1980 64 p
(Contracts NAS7-100; JPL-955291)
(NASA-CR-163388) Avail: NTIS HC A04/MF A01 CSCL 20F

Integrated optic waveguide circuits with a phase bias and modulator on the same chip were designed, fabricated, and tested for use in a fiber-optic rotation sensor (gyro) under development. Single mode fiber-optic pigtails were permanently coupled to the four ports of the chip. The switch format was based on coherent coupling between waveguides formed in Z-cut LiNbO3. The control of the coupling was achieved by electro-optically varying the phase propagation constants of each guide. Fiber-to-chip interfacing required the development of appropriate fixturing and manipulation techniques to achieve the close tolerance needed for high coupling efficiency between a fiber with an approximately 5 micron m core and a channel guide with a roughly 2 micron m by 5 micron m cross section. Switch and chip performance at 0.85 micron m is discussed as well as potential improvements related to insertion loss reduction, switching voltages, and suppression of Li2O out-diffusion. A.R.H.

N80-29158# Colorado Univ. at Boulder. Electromagnetics Lab.
A HYBRID METHOD FOR PARAXIAL BEAM PROPAGATION IN MULTIMODE OPTICAL WAVEGUIDES
David C. Chang and Edward F. Kuester Jan. 1980 36 p refs (Grant DAAG29-78-G-0173)
(AD-A084748; SR-54; ARO-15632.3-EL) Avail: NTIS HC A03/MF A01 CSCL 20/6

A hybrid (non-ray, non-modal) method for computing the fields of a paraxial beam propagating in a multimode waveguide (parallel-plate or dielectric slab) at large axial distances is presented. The method is based on the Fourier and Fresnel self-imaging properties of these waveguides, and is capable of high accuracy. The method is much more efficient than ray or mode approaches, while giving complete field information which coupled-powers equations do not provide. GRA

N80-29159# Spectronics, Inc., Richardson, Tex.
LOW COST FIBER OPTIC MODULE DEVELOPMENT PROGRAM Final Report, Aug. 1978 - Sep. 1979
Ben R. Elmer and Gary R. Mangus Wright-Patterson AFB, Ohio AFAL Dec. 1979 77 p refs
(Contract F33615-78-C-1490; AF Proj. 6096)
(AD-A084882; AFAL-TR-79-1216) Avail: NTIS HC A05/MF A01 CSCL 20/6

This document is the final report of a development program to design, fabricate, test, and deliver approximately 50 sets of transmitter and receiver modules to transmit data via fiber optic bundles at data rates of 10KB/s to 10MB/s. The modules' inherent characteristics are displayed using block diagrams with each important element of the diagram described. The design, testing, test results, and assembly of the modules are included. Also included are the application sections written to inform users of the characteristics of the modules. GRA

N80-29160# Battelle Pacific Northwest Labs., Richland, Wash.
HIGH THROUGHPUT DIMENSIONAL MEASUREMENTS WITH ELECTRO-OPTICS
K. L. Swinth, R. A. Walker, and N. G. Nedrow 1979 15 p refs Presented at 23rd Ann. Intern. Symp. of the Soc. of Phot. Instrumentation Engr., San Diego, Calif., 27 Aug. 1979 Sponsored in part by U.S. Army
(Contract EY-76-C-06-1830)
(PNL-SA-7737; CONF-790838-5) Avail: NTIS HC A02/MF A01

The profile monitor was developed to measure part dimensions with a standard deviation of 0.0001 inch at a throughput rate of 1200 parts/minute. It is one measurement system on an advanced high speed inspection system designed to monitor the production of cartridge cases. The profile monitor is an electro-optic system that utilizes fiber optics to project an image of the case onto charged-coupled device image sensors. Measurements are made for five different case dimensions: (1) head thickness, (2) head diameter, (3) extractor groove diameter, (4) gas seal length, and (5) total length. The profile monitor consists of five major elements: the case gauging fixture, the optical system including an illumination source and computer. Electronics consist of the diode array and driver, thresholding circuit, measurement timing logic and data buffers. DOE

N80-29161# Ecole Nationale Superieure des Telecommunications, Paris (France). Dept. Electronique et Physique.
OPTICAL HETERODYNE RECEPTION FOR A FREE-AIR LASER LINK [RECEPTION OPTIQUE HETERODYNE POUR UNE LIAISON LASER A L'AIR LIBRE: INTERET ET DIFFICULTES DE MISE EN OEUVRE]
Mondher Attia and Philippe Gallion Sep. 1979 102 p refs In FRENCH
(ENST-D-79017) Avail: NTIS HC A06/MF A01

The theoretical and practical aspects of the different elements of a free-space laser transmission/reception system are presented and the corresponding schemas are given. The characteristics of this mode of propagation and the properties of the transmitting medium (atmospheric turbulence) were studied. The following topics are covered: modulators, photodetection and the advantages of heterodyne reception, gas lasers, multimode/single mode conversion, and frequency stability. Author (ESA)

N80-29162# National Bureau of Standards, Washington, D.C. National Engineering Lab.
CONTRIBUTIONS TO COLOR SCIENCE Final Report
Deane B. Judd and David L. MacAdams, ed. Sep. 1979 765 p refs Prepared in cooperation with Rochester Univ., N.Y.
(PB80-174568; NBS-SP-545; LC-76-600132) Avail: NTIS HC A99/MF A01 CSCL 20F

The contents of this collection include some of the major contributions to such areas as the measurement and specification of color, spectrophotometry, color appearance and spacing, and color vision. Each paper is preceded by an introduction which provides general commentary on the article and explains the terminology used. Some introductions also direct the reader to related articles in the collection and point out significant developments, such as international agreements. GRA

N80-29163# National Bureau of Standards, Gaithersburg, Md. National Engineering Lab.
AN ASSESSMENT OF THE BACKSCATTER TECHNIQUES AS A MEANS FOR ESTIMATING LOSS IN OPTICAL WAVEGUIDES
B. L. Danielson Feb. 1980 88 p refs Sponsored in part by Aerospace Guidance and Metrology Center, Newark AFS, Ohio and Army Communications Command, Ft. Monmouth, N.J.
(PB80-170533; NBS-TN-1018) Avail: NTIS HC A05/MF A01 CSCL 20F

Some of the problems associated with determining the accuracy of the backscatter technique as it is applied to the estimation of attenuation in optical waveguides are addressed. The basic theoretical assumptions involved in optical time domain reflectometry are reviewed. The effect on calculated loss values resulting from a departure from these assumptions is then examined. Computer modeling permits numerical comparison between the direct (insertion) method of measuring attenuation and several methods of estimating attenuation from analysis of backscatter data. Numerous examples are given of physical effects which can produce discrepancies in attenuation values. Also,

some experimental comparisons are made between backscatter derived and directly measured attenuation values in step and graded index optical waveguides. GRA

N80-29164# Rensselaer Polytechnic Inst., Troy, N. Y. Dept. of Chemistry.
***COLORIMETRY OF FLUORESCENT SPECIMENS: A STATE-OF-THE-ART REPORT* Final Report**
Fred W. Billmeyer, Jr. Oct. 1979 49 p refs Sponsored in part by Occupational Safety and Health Administration, Washington, D.C.
(PB80-165590; NBS-GCR-79-185) Avail: NTIS HC A03/MF A01 CSCL 20F

There is a complicating overlapping wavelength region in which both excitation and emission take place. Conformance to better color specifications requires irradiation by a source identical to CIE standard daylight illuminant D65, but existing instrument daylight simulators provide a widely discrepant range of results. Calculation methods are described allowing these results to be converted to those for D65 by computation. Instrument modifications and accompanying material standards are proposed for direct measurements corresponding to D65 irradiation. A proposed field test method and instrument are described. Recommendations for implementing these techniques are made for both short-term and long-term time frames. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-29165 Paris XI Univ., Orsay (France). Inst. d'Electronique Fondamentale.
PRELIMINARY STUDY OF A CARBON ION BEAM (55 MeV) GENERATED PLASMA Final Report [ETUDE PRELIMINAIRE D'UN PLASMA PRODUIT PAR UN FAISCEAU D'IONS CARBONE DE 55 MEV]
Louis Wartski Jul. 1978 23 p ref In FRENCH; ENGLISH summary Presented at the 1st Intern. Symp. on Nucl. Induced Plasmas and Nucl. Pumped Lasers, Orsay, 23-25 May 1978 Submitted for publication
(Contract DGRST-76-7-1439)
Avail: NTIS HC A02

A 0.5NA carbon 12.5 ion beams from a Van de Graaff accelerator was used to simulate a nuclear induced plasma. Gaseous targets in the form or variable pressure (10 to a few hundred torr) pure neon and helium-neon mixtures were used. Classical diagnostic measurements (Langmuir probe, microwave cavity, optical spectroscopy) were made on the plasma generated. It was possible to determine the electron density, temperature and distribution functions of the plasma. Author (ESA)

N80-29166# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
FORCE-FREE ANALYTICAL THREE-DIMENSIONAL TOROIDAL MHD-EQUILIBRIA OF ARBITRARY CROSS SECTION
Ferdinand F. Cap Jun. 1980 21 p refs
(UNICP-FSP-80/1) Avail: NTIS HC A02/MF A01

The equation curl vector B = gamma vector B describing force free MHD equilibria is solved in three dimensional rotational coordinates for a torus with arbitrary cross section. An analytical three dimensional and an axisymmetric two dimensional example is given for a torus of circular cross section. M.G.

N80-29167# Nagoya Univ. (Japan). Inst. of Plasma Physics.
EFFECTS OF IMPURITY IONS ON THE ANOMALOUS DIFFUSION DUE TO THE DISSIPATIVE TRAPPED ION INSTABILITY
Akiyoshi Hatayama and Masatada Ogasawara (Keio Univ.) Jun. 1980 37 p refs
(IPPJ-468) Avail: NTIS HC A03/MF A01

The anomalous diffusion coefficient is evaluated by using renormalized perturbation theory for the turbulent collision. Two cases are investigated for light impurity ions, one in the plateau regime and the other in the banana regime. Time evolution of wave spectrum is solved numerically and then the saturated values of the diffusion coefficients are determined, by taking the density gradient of the impurity in the same direction as that of the bulk plasma. Even with a small concentration of the impurity the diffusion coefficient takes a smaller value for both regime cases. M.G.

N80-29168# Nagoya Univ. (Japan). Inst. of Plasma Physics.
STOCHASTICITY OF PHASE TRAJECTORY OF A CHARGED PARTICLE IN A PLASMA WAVE
Akihiko Murakami, Yasuyuki Nomura, and Hiromu Momota Jun. 1980 48 p refs
(IPPJ-464) Avail: NTIS HC A03/MF A01

Stochastic behavior of charged particles in finite amplitude plasma waves is examined by means of particle simulations under the condition that Chirikov's criterion is broken down. The process of growing the stochastic region is clarified and accordingly the width of the stochastic region is discussed. Discussions on the effects of higher order resonances are also presented. Author

N80-29169# Nagoya Univ. (Japan). Inst. of Plasma Physics.
NUMERICAL STUDY OF LHRF-HEATING IN A TOKAMAK
Tsuyoshi Imai (Japan Atomic Energy Research Inst., Ibaraki), Masao Okamoto, and Takashi Nagashima (Japan Atomic Energy Research Inst., Ibaraki) Jun. 1980 35 p refs
(IPPJ-467) Avail: NTIS HC A03/MF A01

By use of a one dimensional Tokamak transport simulation code, numerical estimations are performed of the experimental results of lower hybrid range of frequency heating in JFT-2 Tokamak. The coupling of a launched electromagnetic wave to a plasma, and propagation and absorption of the wave are considered within the framework of linear theory and the resultant energy deposition is incorporated into the transport code. The result of simulation gives the maximum heating efficiency of the value of 2-3 eV/kW, when the turning point of lower hybrid wave is located near the center of the plasma column, whereas the experiment obtains 1-1.5 eV/kW. Dependences of the heating efficiency on the phase difference between adjacent waveguides and on the density are calculated. It is found that the density dependence is contrary to that of the experiment. The importance of two dimensional propagation and the nonlinear absorption of waves are indicated. M.G.

N80-29170# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ANALYSIS FOR PRODUCTION OF FAST IONS IN LASER-IRRADIATED TARGET. 1: IN PLANE TARGET (AFFECTION OF ELECTROSTATIC INSTABILITY)
Hiroyuki Murakami (Metropolitan Coll. of Technology), Shigeo Kawata (Tokyo Inst. of Technology), and Keishiro Niu (Tokyo Inst. of Technology) May 1980 30 p refs 2 Vol.
(IPPJ-465-1) Avail: NTIS HC A03/MF A01

The current density of fast ions which are extracted from a laser-irradiated target is analyzed in relation with the current density of fast electrons in a plane and steady framework. The sheath formed by fast electrons plays the extraction mechanism of fast ions from the target. It is pointed out that the two-stream type of instability occurring in the target plays a role in determining the sheath structure and hence the current density of fast ions. M.G.

N80-29171# Nagoya Univ. (Japan). Inst. of Plasma Physics.
ANALYSIS FOR PRODUCITON OF FAST IONS IN LASER-IRRADIATED TARGET. 2: IN SPHERICAL TARGET
Hiroyuki Murakami (Metropolitan Coll. of Technology), Shigeo Kawata (Tokyo Inst. of Technology), and Keishiro Niu (Tokyo Inst. of Technology) May 1980 30 p refs 2 Vol.
(IPPJ-466-2) Avail: NTIS HC A03/MF A01

An analysis is given for the current density of fast ions which are extracted from a laser-irradiated spherical target. The thermal spread in velocity of fast electrons being taken into account, the sheath potential formed around the target to extract fast ions is obtained by solving the Poisson equation. The current density of fast ions is directly correlated with the velocity distribution function of fast electrons and the effective frequency of collisions between fast electrons and the target plasma. Author

N80-29172# Nagoya Univ. (Japan). Inst. of Plasma Physics.
LOWER HYBRID HEATING EXPERIMENTS IN JIPP T-2
K. Ohkubo Jun. 1980 11 p refs Presented at the Intern. Conf. on Plasma Phys., Nagoya, Japan, Apr. 1980
(IPPJ-469) Avail: NTIS HC A02/MF A01

Lower hybrid heating carried out in Tokamak and stellarator plasmas is described. The parametric instability and enhancement of the current-driven ion cyclotron instability is observed. In Tokamak, an effective ion heating as high as 120 eV with input power of 120 kW is obtained. In stellarator, the heating efficiency becomes 1 eV/kW at a power of less than 50 kW and above this level the efficiency decreases. The hybrid device and diagnostic methods are described. M.G.

N80-29173# Nagoya Univ. (Japan). Inst. of Plasma Physics.
AN OPTIMIZATION OF FUSION PLASMA PARAMETERS
Hiromu Momota, Yukihiro Tomita, and Yasuyuki Nomura May 1980 123 p refs
(IPPJ-460) Avail: NTIS HC A06/MF A01

The point of enhancement of the plasma Q value Q sub p (fusion power/injection power) and the radiation parameter psi sub r ((charged particles' fusion power radiation power)/fusion power), and optimum plasma conditions are examined. Fusion fuels considered are for D-T, catalyzed D-D, p-(11)B, and p-(6)Li fusion plasmas. Basic equations for optimizations are the energy and particle balance equations and the charge neutrality condition in each fusion plasma. For catalyzed D-D fusion plasmas, results show a remarkable dependence on the plasma beta value. The radiation parameter can be enhanced through the refuelling of fusion produced tritium after transmutation into helium-3. With regard to p-(11)B and p-(6)Li fusion plasmas, the maximum attainable Q sub p is found to be less than unity, and the resultant psi sub r is negative. A case where niobium is present in a fusion plasma as an impurity is also examined. The acceptable niobium concentration is shown for various fusion fuels and operation conditions of fusion plasmas. M.G.

N80-29174# Nagoya Univ. (Japan). Inst. of Plasma Physics.
GENERALIZED GELFAND-LEVITAN EQUATION AND VARIATIONAL RELATIONS OF THE KAUP-NEWELL EQUATION
T. Kawata and J. Sakai May 1980 29 p refs
(IPPJ-463) Avail: NTIS HC A03/MF A01

The generalized Gelfand-Levitan integral equation is derived for solving the inverse problem of Kaup-Newell eigenvalue problem, which makes it possible to solve the derivative nonlinear Schroedinger equation, etc. by the inverse Fourier spectral transform. By this integral equation, the variation of potentials is obtained as a functional of that of scattering data. The inverse functional relation is also given by perturbing the Kaup-Newell equation as to potentials. For both functionals the contribution from the discrete spectrum is obtained and the completeness of squared eigenfunctions is naturally derived. M.G.

N80-29175# Naval Research Lab., Washington, D. C. Laser Plasma Branch.
NUMERICAL STUDY OF OPTICAL RAY RETRACING IN LASER-PLASMA BACKSCATTER
R. H. Lehmberg and K. A. Holder 1 Apr. 1980 51 p refs
(AD-A084987; AD-E000423; NRL-MR-4192) Avail: NTIS HC A04/MF A01 CSCL 20/9

Optical ray retracing in stimulated Brillouin backscatter from laser produced plasmas is studied numerically, using a 2 D propagation code (BOUNCE). This code treats steady state behavior in the strong damping limit, and includes self focusing effects. Ray retracing phenomena are grouped into two limiting cases. In the 'whole beam' limit, the pump field at the lens has a broad spatial profile that can be focused to a long narrow waist within the plasma. This geometry selectively amplifies only those initial noise components that are propagating back along the axis, where the net gain is highest. The simulations show that such effects exhibit a pronounced threshold due to self focusing, and disappear when the focal width becomes comparable to the length of the gain medium. In the opposite limit, where the pump radiation at the lens is dominated by small scale transverse structure, the backscatter can reproduce this structure in detail (i.e., exhibit wavefront reversal) when the far field of the pump produces an interference pattern in the plasma. The plasma then behaves as an active volume hologram as it amplifies the backward-propagating random noise fields. M.G.

N80-29176# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Physics.
STUDY OF THE ANATOMY OF THE X-RAY AND NEUTRON PRODUCTION SCALING LAWS IN THE PLASMA FOCUS (PARTICLE ENERGY SPECTRUM AND OPTIMIZATION CRITERIA) Final Technical Report, 1 Oct. 1978 - 30 Sep. 1979
V. Nardi, W. H. Bostick, and W. Prior Nov. 1979 41 p refs
(Grant AF-AFOSR-2754-75; AF Proj. 2301)
(AD-A084967; SIT-P2002-1179; AFOSR-80-0411TR) Avail: NTIS HC A03/MF A01 CSCL 20/8

Optimum conditions for plasma focus operations have been experimentally analyzed in terms of (A) The fine structure of the axial-current channel during maximum of compression. (B) Correlation coefficient, for neutron yield n (by D2 discharges) and the multiplicity of the electron beam pulses; (C) Different values of the electrode voltage. The current distribution near the axial plasma column during the explosive decay of the column has been monitored and correlated with the electron beam production. Plasma focus discharges by our mode of operation generate high-intensity neutron beams (approximately 100,000 amp) with a > or approximate 300 keV-peaked spectrum and electron beams, with an energy distribution similarly peaked at 300-400 keV. The energy spectrum is determined by two independent methods (time of flight and target-damage data). The spectrum varies from shot to shot but the main features are observed in all discharges. In each discharge we observe (on a time interval of 100-300 nanosec) a sequence of beam pulses (1-10), with the same multiplicity of the peak in the rate of change (dI/dt) of the electrode current I. The filamentary structure of the electron beam and the internal structure of the filament have been analyzed with a space resolution better than approximately 1 micrometers. GRA

N80-29177# Kansas State Univ., Manhattan. Dept. of Nuclear Engineering.
CONCEPTUAL DESIGN OF A COMMERCIAL TOKAMAK HYBRID REACTOR FUELING SYSTEM
Kenneth D. Matney, Hermann J. Donnert, and Tien-Fang Yang (MIT) Dec. 1979 60 p refs
(Contracts DE-AC02-77ET-51010; EG-77-C-02-4231)
(DOE/ET-51010/6; WFPS-TME-79-032) Avail: NTIS HC A04/MF A01

The relative merits of the cold-fueling concept are compared with those of the hot-fueling concept; that is, fueling where the electron is below 1 eV is compared with fueling where the electron temperature exceeds 100 eV. It is concluded that cold-fueling seems to be somewhat more free of drawbacks than hot-fueling. Possible implementation of the cold-fueling concept is exploited via frozen pellet injection. Several methods of achieving frozen pellet injection are discussed and the light-gas-gun approach is chosen from these possibilities. A modified version of the ORNL neutral gas shielding model is used to simulate the pellet injection process. From this simulation, the penetration depth dependent velocity requirement is determined. Finally, with the velocity requirement known, a gas pressure requirement for the proposed conceptual design is established. The cryogenic fuel injection and fuel handling systems are discussed. A possible way to implement the conceptual device is examined along with the attendant effects on the total system. DOE

N80-29178# Los Alamos Scientific Lab., N. Mex.
RESISTIVE G-MODES AND BALLOONING
R. Y. Dagazian, J. P. Mondt, and R. B. Paris (Association Euratom-CEA, Fontenay-aux-Roses, France) 1980 12 p Presented at the Workshop on Optimization of Toroidal Confinement, Hiroshima, 14-17 Apr. 1980
(Contract W-7405-eng-36)
(LA-UR-80-738; CONF-800435-1) Avail: NTIS HC A02/MF A01

A unified theory of the linear stability of the Roberts and Taylor type of resistive interchange and ballooning is presented. The effects of both parallel and perpendicular viscosity as well

as of finite shear and finite beta are included in a MHD treatment of the problem. Kinetic effects are also studied. The hybrid kinetic model with Vlasov ions and guiding center electrons was appropriately generalized to allow for electron-ion collisions. The geometry is that of a plane slab with magnetic shear. DOE

N80-29179# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
PERFORMANCE OF A PLASMA JET IGNITER
B. Cetegen, K. Y. Teichman, F. J. Weinberg, and A. K. Oppenheim Jan. 1980 42 p refs Presented at the SAE Automotive Eng. Congr. and Exposition, Detroit, 25 Feb. 1980
(Contract W-7405-eng-48; Grant NSF ENG-78-12372)
(LBL-10365; CONF-800202-3) Avail: NTIS HC A03/MF A01

Experimental and analytical procedures that were developed to determine the performance of a jet igniter with particular emphasis on the fluid mechanic effects are described. The results are based on high speed schlieren cinematography of the combustion process in a cylindrical bomb, and simultaneous pressure transducer measurements. The penetration depth is shown to be proportional to the square root of the characteristic length, the ratio of the volume of igniter cavity to its orifice area. The capability to ignite lean mixtures is demonstrated by the repeatibility of results attained with the use of methane-air mixtures at an equivalence ratio of 0.6, initially at atmospheric pressure and room temperature. While the laminar burning velocity was well within the range reported in the literature, the corresponding turbulent burning velocity was about three times greater, the ratio between the two remaining nearly constant throughout the process. DOE

N80-29180# Los Alamos Scientific Lab., N. Mex.
ZERO DIMENSIONAL PLASMA MODEL AND THE STUDY OF THE INITIAL PERFORMANCE OF THE ZT-40 EXPERIMENT
S. Ortolani (Padova Univ.) Feb. 1980 46 p refs
(Contract W-7405-eng-36)
(LA-8261-MS) Avail: NTIS HC A03/MF A01

The initial performance of the ZT-40 experiment was studied by a zero dimensional plasma model. A computer code (ZCODEX) was written on the PDP-10 to solve the equations of the model. The code was written by adding other equations and terms to the OXYALU code. The main features of the model are summarized, some aspects of how to use the code are described, some results obtained in simulating the ZT-40 experimental performance are discussed. The model is essentially an extension of time dependent impurity radiation calculations. The code, written on the PDP-10, is similar to the one written in Padua on the IBM computer. DOE

N80-29181# Kanner (Leo) Associates, Redwood City, Calif.
NUMERICAL MODELLING OF THE COMPRESSION OF A TOROIDAL PLASMA BY A QUASISPHERICAL LINER
V. A. Gasilov (Adacemy of Sciences, USSR), V. M. Goloviznin (Academy of Sciences, USSR), R. Kh. Kurtmullaev (Academy of Sciences, USSR), V. N. Semonov (Academy of Sciences, USSR), N. V. Sosnin (Academy of Sciences, USSR), V. F. Tishkin (Academy of Sciences, USSR), A. P. Favorskii (Academy of Sciences, USSR), and M. Yu. Shashkov (Academy of Sciences, USSR) 1980 37 p refs Transl. into ENGLISH of Russian preprint "Chislennoe Modelirovanie Kompressii Torodialnoi Plazmy Kvazisfericheskim Lainerom", Akademii Nauk SSSR, Moscow, Inst. Prikladnoi Matematiki, 1979 Prepared for Los Alamos Scientific Lab.
(Contract W-7405-eng-36)
(LA-TR-80-3) Avail: NTIS HC A03/MF A01

The problem of the dynamics of a heavy profiled envelope, compressing a compact plasma toroid with a frozen-in magnetic field, is resolved numerically. It is shown that, by the succeseful profiling of velocity at the initial moment, such a mode of compression of the plasma may be achieved, that, starting from some time, the form of the cavity under the liner is close to quasispherical. In this mode, the compression coefficient may reach 1000. DOE

N80-29182# Ad-Ex International, Portola Valley, Calif.
TRANSVERSE CONFINEMENT OF HIGH-PRESSURE PLASMA IN A CORRUGATED MAGNETIC FIELD
S. L. Musher (Academy of Science, USSR) and M. D. Spektor (Academy of Science, USSR) Nov. 1979 25 p refs Transl. into ENGLISH from preprint no. 94, Novosibirsk, 1979 Submitted for publication Sponsored by DOE Prepared for California Univ., Lawrence Livermore Lab., Livermore
(UCRL-Trans-11527) Avail: NTIS HC A02/MF A01

The confinement of a high pressure plasma in a multimirror magnetic configuration with a corrugated metallic shell is studied analytically and numerically. Equations that describe the dynamics of a dense plasma in a corrugated magnetic field are derived and it is shown that the structure of the magnetic field lines is preserved when the hot plasma expands transversely, and that the energy lifetime tau sub perpendicular is of order R(2)/chi (where chi is Bohm's thermal diffusivity). DOE

N80-29183# Westinghouse Electric Corp., Pittsburgh, Pa. Fusion Power Systems Dept.
BLANKET DESIGN STUDY FOR A COMMERCIAL TOKAMAK HYBRID REACTOR (CTHR)
D. L. Chaplin, L. Green, A. Y. Lee, M. E. Culbert, and J. L. Kelly Sep. 1979 129 p refs
(Contract EG-77-C-02-4544)
(WFPS-TME-79-021) Avail: NTIS HC A07/MF A01

The results are presented of a study on two blanket design concepts for application in a commercial Tokamak hybrid reactor. Both blankets operate on the U-Pu cycle and are designed to achieve tritium self-sufficiency while maximizing the fissile fuel production within thermal and mechanical design constraints. The two blanket concepts that were evaluated were: (1) a UC fueled, stainless steel clad and structure, helium cooled blanket; and (2) a UO2 fueled, zircaloy clad, stainless steel structure, boiling water cooled blanket. Two different tritium breeding media, Li2O and LiH, were evaluated for use in both blanket concepts. The use of lead as a neutron multiplier or reflector and graphite as a reflector was also considered for both blankets. DOE

N80-29184# Kansas State Univ., Manhattan. Dept. of Chemistry.
EXPERIMENTAL INVESTIGATION OF THE CHEMISTRY OF EXCITED STATES OF RARE GASES Final Report, 15 Oct. 1978 - 14 Oct. 1979
D. W. Setser Feb. 1980 11 p refs
(Contract EY-76-S-02-2807)
(COO-2807-19) Avail: NTIS HC A02/MF A01

The status of photosensitized studies of reactions of Xe(p-3(2)) and Kr(p-3(1)) with fluorine, chlorine, bromine, and iodine donors is reported. Results for KrCl and KrF are summarized. DOE

N80-29185# General Atomic Co., San Diego, Calif.
PRELIMINARY RESULTS OF NONCIRCULAR PLASMA EXPERIMENTS IN DOUBLET 3
Tihiro Ohkawa Feb. 1980 17 p refs Presented at Intern. School of Plasma Phys. Workshop, Varenna, Italy, 27 Aug. - 8 Sep. 1979 Submitted for publication
(Contract DE-AT03-76ET-51011)
(GA-A-15801) Avail: NTIS HC A02/MF A01

Preliminary results of noncircular plasma experiments in doublet plasmas with high-Z limiters are described. Electron energy confinement and maximum plasma density are in agreement with standard circular Tokamak empirical scaling laws. Chromium and molybdenum appear to be the dominant high-Z contaminants while carbon appears to dominate low-Z contaminants. High-Z impurity radiation does not appear to dominate the central power balance. DOE

N80-29186# Fom-Instituut voor Atoom- en Molecuulfysica, Amsterdam (Netherlands).
THE ENERGY CONFINEMENT IN HIGH-DENSITY TOKAMAKS
D. C. Schram (Eindhoven Univ., Netherlands) and F. C. Schueller Sep. 1979 45 p refs Sponsored by EURATOM and Nederland Organization voor Zuiver-Wetenschappelijk Onderzoek (ZWO)
(Rept-77-104) Avail: NTIS HC A03/MF A01

A method based on the assumption that the experimental profiles can be approximated by Gaussians is presented. Analytic expressions for various plasma quantities as a function of the radius are given. The ohmic power input is compared with the power transported by ion heat conduction for a typical discharge

in Alcator. This comparison shows that, within the radius of interest for confinement properties, the plateau-ion heat conduction is the major loss mechanism. Author (ESA)

N80-29187# Fom-Instituut voor Atoom- en Molecuulfysica, Amsterdam (Netherlands).
LOW-FREQUENCY MODES WITH HIGH TOROIDAL MODE NUMBERS: A GENERAL FORMULATION
F. Pegoraro and T. J. Schep Sep. 1979 63 p refs Sponsored by EURATOM, Nederland Organization voor Zuiver-Wetenschappelijk Onderzoek (ZWO) and Scuola Normale Superiore, Pisa, Italy
(Rept-77-119) Avail: NTIS HC A04/MF A01

Low frequency waves with high toroidal mode numbers in an axisymmetric toroidal configuration are studied. In particular, the relationship between the periodicity constraints imposed by the geometry, magnetic shear and the spatial structure of eigenmodes is investigated. By exploiting the radial translational invariance and the poloidal periodicity of the gyro-kinetic and Maxwell equations, the two dimensional problem can be converted into a one dimensional one and the mode structure can be expressed in terms of a single extended poloidal variable. This representation is used in the description of electromagnetic modes with phase velocities larger than the ion thermal velocity and with frequencies below the ion gyro-frequency. Trapped particle curvature and compressional effects are retained. The dispersion equations for drift modes and Alfven-type modes are given in general geometry and simplified solutions are presented in the configuration of a double periodic plane slab. Author (ESA)

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

N80-29188 California Univ., Berkeley.
DENSITY VARIATION IN THE ELECTRON-HOLE LIQUID IN STRESSED GERMANIUM AND SILICON Ph.D. Thesis
Susan Mary Kelso 1979 411 p
Avail: Univ. Microfilms Order No. 8014758

The variation in electron hole pair density in the electron-hole liquid (EHL) in stressed Ge and Si was investigated. First, the variation of the density and other properties of the EHL was studied theoretically as a function of uniaxial stress in both Ge and Si. Second, the variation of the density with position was studied both theoretically and experimentally in the strain confined electron hole liquid (SCEHL) in Ge. The properties of the strain confined EHL were determined from measurements of the recombination luminescence with spatial, time, and spectral resolution, as a function of excitation level, magnetic field, temperature, and stress. The compression of the SCEHL at higher excitation levels was investigated in detail. It is shown theoretically that the density should vary with position, with the magnitude of the variation increasing with drop size.
Dissert. Abstr.

N80-29189 Cornell Univ., Ithaca, N. Y.
A STUDY OF THE STRUCTURAL PROPERTIES OF METALLIC SYSTEMS. 1: METALLIC HYDROGEN. 2: CORE-POLARIZATION AND THE STRUCTURE OF SIMPLE METALS Ph.D. Thesis
Kin Keung Mon 1980 127 p
Avail: Univ. Microfilms Order No. 8015712

Upper bounds for the ground state energies of liquid and solid phases of metallic hydrogen and metallic deuterium were calculated with variational methods and Monte Carlo techniques. At four densities (r_s = 0.8, 1.2, 1.36, and 1.488) crystalline phases are clearly preferred in the sense that the energy difference when compared to the liquid is in excess of the errors inherent in the numerical procedures. At a fifth density, (r_s 1.6), the energy differences between solid and liquid phases are smaller than these errors. Liquid simple metals such as Ga and Sn have static structure factors S(k) that appear to depart appreciably from the predictions of standard central force models of liquid structure. They are shown to be a consequence of corresponding structure introduced into the effective ion-ion interaction by the inclusion of dynamically screened fluctuating dipole interactions between ion cores. A calculation of the effective ion-ion potential therefore requires a knowledge of the frequency dependent ionic and electron gas polarizabilities and the one-electron pseudopotential. Model potentials based on reasonable estimates of all of these are used in conjunction with simulation (Monte Carlo) methods to show that the structural anomalies can indeed be attributed to corepolarization effects. Dissert. Abstr.

N80-29190*# Duke Univ., Durham, N. C. Center for Solid-State Power Conditioning and Control.
RESEARCH ON DESIGN FEASIBILITY OF HIGH-POWER LIGHT-WEIGHT dc-TO-dc CONVERTERS FOR SPACE POWER APPLICATION Semiannual Status Report, period ending 31 May 1980
Thomas G. Wilson 31 May 1980 47 p refs
(Grant NsG-3157)
(NASA-CR-163375; SASR-6) Avail: NTIS HC A03/MF A01 CSCL 20L

The development of 5 kW converters with 100 kHz switching frequencies, consisting of two submodules each capable of 2.5 kW of output power, is discussed. Two semiconductor advances allowed increased power levels. Field effect transistors with ratings of 11 A and 400 V were operated in parallel to provide a converter output power of approximately 2000 W. Secondly, bipolar power switching transistor was operated in conjunction with a turn-off snubber circuit to provide converter output power levels approaching 1000 W. The interrelationships between mass, switching frequency, and efficiency were investigated. Converters were constructed for operation at a maximum output power level of 200 W, and a comparison was made for operation under similar input/output conditions for conversion frequencies of 20 kilohertz and 100 kilohertz. The effects of nondissipative turn-off snubber circuitry were also examined. Finally, a computerized instrumentation system allowing the measurement of pertinent converter operating conditions as well as the recording of converter waveforms is described. M.G.

N80-29191*# Rockwell International Science Center, Thousand Oaks, Calif.
THE 3-5 SEMICONDUCTOR SOLID SOLUTION SINGLE CRYSTAL GROWTH Annual Report, 6 Apr. 1979 - 15 Mar. 1980
E. R. Gertner May 1980 50 p refs
(Contract JPL-955352)
(NASA-CR-163395; JPL-9950-380; SC5210.24AR) Avail: NTIS HC A03/MF A01 CSCL 20L

Techniques used for liquid and vapor phase epitaxy of gallium indium arsenide are described and the difficulties encountered are examined. Results show that the growth of bulk III-V solid solution single crystals in a low gravity environment will not have a major technological impact. The float zone technique in a low gravity environment is demonstrated using cadmium telluride. It is shown that this approach can result in the synthesis of a class of semiconductors that can not be grown in normal gravity because of growth problems rooted in the nature of their phase diagrams. A.R.H.

N80-29192# Princeton Univ., N. J.
FREE SURFACE PROPERTIES OF 3-5 COMPOUND SEMICONDUCTOR SURFACES Final Report, 1 Apr. 1974 - 31 Mar. 1980
A. Kahn Jun. 1980 20 p refs
(Grants DAHC04-74-G-0133; DAAG29-77-G-0116)
(AD-A085303; ARO-11671.18-EL; ARO-14710.12-EL) Avail: NTIS HC A02/MF A01 CSCL 20/12

Studies of free compound semiconductor surfaces as well as gas-solid and metal-solid interaction are summarized. An experimental and theoretical analysis of the GaAs(110) surface reconstruction was conducted and applied to three additional compounds: InSb, InP and ZnTe. Attempts were made to relate the type and the magnitude of the surface reconstruction of these materials to the covalent-ionic character of the bonding. Knowledge of the atomic reconstructions of these surfaces was used to investigate the reactivity of semiconductor surfaces (GaAs(110)) with gas (oxygen) and metal (aluminum) atoms. These multicomponent systems are at the center of the author's

essays to understand the chemistry of these surfaces and its relationship with their atomic reconstruction. Using Low Energy Electron Diffraction (LEED) as the principal tool to investigation, structural information has been obtained which correlates chemical and electronic information obtained by other surface analysis techniques. GRA

N80-29193# Naval Research Lab., Washington, D. C. Radiation-Matter Interaction Branch.
USING THE BINARY-COLLISION CASCADE SIMULATION CODE MARLOWE ON THE ASOC
G. P. Mueller 20 Mar. 1980 4 p
(RRD120141)
(AD-A084988; AD-E000421; NRL-MR-4193) Avail: NTIS HC A02/MF A01 CSCL 20/2

The binary-collision cascade simulation code MARLOWE is used to study the effects of irradiations on crystalline materials. We modified the IBM version of MARLOWE to run on the Texas Instruments ASC at NRL. This report outlines the changes made in the code and details how NRL users can access the code. GRA

N80-29194# Army Electronics Research and Development Command, Fort Monmouth, N. J.
QUARTZ CRYSTAL FABRICATION FACILITY Final Report, 1 Apr. 1977 - 30 Sep. 1979
R. J. Ney May 1980 65 p refs
(Contract DE-AC04-76DP-00656)
(AD-A084788; ERADCOM-HH610964CPW3/02A) Avail: NTIS HC A04/MF A01 CSCL 13/8

The report describes the design and operation of a five chamber, interconnected vacuum system, which is capable of cleaning, plating, and sealing precision quartz crystal units in ceramic flatpack enclosures continuously in a high vacuum environment. The production rate design goal was 200 units per eight hour day. A unique nozzle beam gold deposition source was developed to operate for extended periods of time without reloading. The source puts out a narrow beam of gold typically in the order of 2 1/2 deg included cone angle. Maximum deposition rates are in the order of 400 a/min at 5.5 in. 'throw' distance used. Entrance and exit air lock chambers expedite the material throughput, so that the processing chambers are at high vacuum for extended periods of time. A stainless steel conveyor belt, in conjunction with three vacuum manipulators, transport the resonator components to the various work stations. Individual chambers are normally separated from each other by gate valves. The crystal resonators, mounted in flatpack frames but unplated, are loaded into transport trays in a lid-frame-lid sequency for insertion into the system and exit as completed crystal units. The system utilizes molybdenum coated ball bearings at essentially all friction surfaces. The gold sources and plating mask heads are equipped with elevators and gate valves, so that they can be removed from the system for maintenance without exposing the chambers to atmosphere. GRA

N80-29195# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
A STUDY OF FLICKER NOISE IN MOSFETS Final Report, 16 Mar. 1979 - 15 Mar. 1980
A. VanderZiel May 1980 13 p refs
(Contract DAAG29-79-C-0078)
(AD-A085278; ARO-16441.4-EL) Avail: NTIS HC A02/MF A01 CSCL 09/1

Work accomplished and published between March 1979 and March 1980 involving the high-frequency excess noise and flicker noise in GaAs MESFETs, the high-frequency excess noise and flicker noise in MOSFETs, noise in triodelike JFETs, and noise in two MOSFET types made by the DMOS process is reviewed. GRA

N80-29196# Illinois Univ. at Chicago Circle, Chicago. Dept. of Physics.
PHOTOLYTIC PRODUCTION OF EXCITED STATES AND COLLISIONAL PHENOMENA FOR LASER FUSION APPLICATIONS
R. T. Hawkins and C. K. Rhodes Dec. 1979 137 p refs
(Contracts DE-AS08-78DP-40025; ED-78-S-08-1603)
(NVO-1603-2) Avail: NTIS HC A07/MF A01

The development and use of high spectral brightness rare gas halogen sources are discussed. At 248 nm, a source whose spectral width and beam divergence approach the fundamental limits of physical optics is described. This device is clearly scalable to terawatt power levels. Such high brightness devices can be readily utilized to examine a broad range of atomic and molecular phenomena pertinent to laser development. These studies include state specific kinetic processes, excited state photoionization, electron collisional mechanisms, and a variety of multiquantum processes. DOE

N80-29197# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
MICROSTRUCTURE DEVELOPMENT AND INTERFACE STUDIES IN THICK FILM CONDUCTOR SYSTEMS Ph.D. Thesis
V. K. Nagesh Dec. 1979 147 p refs
(Contract W-7405-eng-48)
(LBL-9274) Avail: NTIS HC A07/MF A01

A Thick film conductor system which used acid treated (.01N HCl) lead borosilicate glass particles with chemically coated metal (silver) film was developed. Using only 40 wt% metal (silver), sheet resistivities as low as 45 milliohms/sq were obtained in this system. Detailed study of the microstructure development was done. Effect of the acid treatment of the glass particles prior to the metal coating was analyzed. The X-ray photoelectron spectra studies showed preferential leaching of lead and boron from the surface of the glass. Good bonding between silver film and the glass was attributed to the oxidation of silver (to form Ag(+)) in the presence of oxygen and H(+) ions on the glass surface (from acid treatment) and subsequent diffusion of Ag(+) into the glass to form a continuous chemical interface. A model to predict sheet resistivities of the new thick film conductors was developed. DOE

N80-29198# National Technical Information Service, Springfield, Va.
IMPATT DIODES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Mar. 1980
William E. Reed Apr. 1980 203 p Supersedes NTIS/PS-79/0296; NTIS/PS-78/0380
(PB80-808322; NTIS/PS-79/0396; NTIS/PS-78/0380) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

Government sponsored research reports are cited covering the design, characterization, and applications of IMPATT diodes. Topics include reliability, power handling, properties, noise, fabrication, and radiation effects. The use of silicon and gallium arsenide IMPATT diodes for microwave generation and amplification is included. This updated bibliography contains 182 abstracts, 14 of which are new entries to the previous edition. GRA

N80-29199# National Technical Information Service, Springfield, Va.
IMPATT DIODES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1978 - Mar. 1980
William E. Reed Apr. 1980 178 p Supersedes NTIS/PS-79/0398; NTIS/PS-78/0381
(PB80-808330; NTIS/PS-79/0398; NTIS/PS-78/0381) Avail: NTIS HC $30.00/MF $30.00 CSCL 09A

Research reports covering the design, characterization, and applications of IMPATT diodes are cited from worldwide research. Topics include reliability, power handling, properties, noise, fabrication, and mathematical analysis. The use of silicon and gallium arsenide IMPATT diodes for microwave generation and amplification are included. This updated bibliography contains 171 abstracts, 63 of which are new entries to the previous edition. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-29200 Pennsylvania State Univ., University Park.
THERMODYNAMIC AND MOLECULAR PROPERTIES IN HIGH TEMPERATURE GASEOUS SYSTEMS Ph.D. Thesis
David Louis Drapco 1980 159 p
Avail: Univ. Microfilms Order No. 8015793

The structure and thermodynamic properties of high temperature vapors were investigated. Vapor pressures of Ti2Cl2(g) were measured relative to TiCl(g) by Knudsen effusion mass spectrometry in the temperature range 543 to 615 K. Absolute pressures were determined by comparison with the known vapor pressure of TiCl(g). Thermodynamic functions were also determined for TiCl(g) and Ti2Cl2(g) based upon recent spectroscopic data.
Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-29201# Massachusetts Inst. of Tech., Cambridge. Lab. for Information and Decision Systems.
OPEN-LOOP SOLUTIONS FOR THE DYNAMIC ROUTING PROBLEM
Samuel Shats and Adrian Segall May 1980 49 p refs
(Contracts N00014-75-C-1183; N00014-77-C-0532)
(AD-A085109; LIDS-R-992) Avail: NTIS HC A03/MF A01 CSCL 12/2

This work deals with the problem of obtaining an open-loop solution to the minimum delay dynamic routing problem. The dynamic routing problem is stated using a dynamic model suggested in previous works. This work uses some previously known properties of the optimal solution and formulates the routing problem as a cubic optimization problem. In general such problems are very hard to solve; however, the specific problem at hand is finally formulated as a nonconvex quadratic program by using its special structure. Two different approaches, based on the latter representation of the problem, are proposed: (a) utilization of existing methods for solving nonconvex quadratic programs, (b) development of a special purpose algorithm. The algorithm is developed for single destination networks with unity weightings in the cost functional, and it finds the optimal solution by solving a series of linear programs. The algorithm is based on a series of specially developed theorems. These theorems provide use with new insight into the behaviour of the dynamic routing in networks. The method is implemented by a computer program and several examples are run to test its applicability.
GRA

N80-29202# Federal Coordinating Council for Science, Engineering and Technology, Washington, D. C.
A RESEARCH AND DEVELOPMENT MANAGEMENT APPROACH: REPORT OF THE COMMITTEE ON APPLICATION OF OMB CIRCULAR A7-76 TO R AND D
31 Oct. 1979 105 p refs
(PB80-170053) Avail: NTIS HC A06/MF A01 CSCL 05A

The general policy of the Government is established to buy the products and services it needs and to provide them, using Government resources, only on an exception basis. The need for research and development activities as a Government function is recognized through the inclusion of an 'in-house core capability' in the area of research development and testing. It is also recognized that additional guidance is required to apply the policy to research and development activities and an interagency committee under the auspices of the Federal Coordinating Council for Science, Engineering and Technology was established to study the issues and recommended guidelines for consistent and uniform agency implementation.
GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-29203# General Accounting Office, Washington, D. C. Program Analysis Div.
THE NATIONAL SCIENCE FOUNDATION'S MANAGEMENT INFORMATION SYSTEM: A STATUS REPORT
8 Apr. 1980 77 p
(AD-A084753; GAO/PAD-80-7) Avail: NTIS HC A05/MF A01 CSCL 05/1

The review of the current status of the National Science Foundation's management information system and its plans for making needed improvements focuses on identifying changes planned or in process, quality controls, user satisfaction, and cost. Reliability problems, including inaccurate and incomplete data and slow response time at computer terminals, seriously impair the system's effectiveness and frustrate its users. Recommendations for management and technical improvements made by a Foundation consultant 3 years ago have not been carried out. September 1979 study of system performance also pointed out the need for many system improvements. The Foundation can increase system reliability by improving quality control, system response time, long-range planning, performance evaluation, and administrative management. The Foundation also should determine users' needs, and establish specific, quantified goals and target dates for correcting deficiencies.
GRA

N80-29204# Naval Postgraduate School, Monterey, Calif.
ON-LINE REAL-TIME MANAGEMENT INFORMATION SYSTEMS AND THEIR IMPACT UPON USER PERSONNEL AND ORGANIZATIONAL STRUCTURE IN AVIATION MAINTENANCE ACTIVITIES M.S. Thesis
Benjamin A. Bayma, Jr. Dec. 1979 97 p refs
(AD-A085111) Avail: NTIS HC A05/MF A01 CSCL 15/7

The introduction of a new technology into an organization can significantly impact the organization's effectiveness. Some possible effects on user personnel and organizational structure during and after the implementation of an on-line real-time computer-based management information system are explored in this thesis. The organizational structure and Management Information Service (MIS) users within aviation maintenance activities are identified. The possible impact on the informal and formal decision-making structures within these activities is predicted using a contingency model. Possible implementation strategies to minimize that impact and maximize the probability of MIS implementation success are investigated. The Naval Aviation Logistics Command Management Information System (NALCOMIS) is used as a vehicle to predict possible implementation impacts and strategies. The NALCOMIS Project Manager and his staff are provided with a partial list of possible problems areas to be aware of during NALCOMIS implementation.
GRA

N80-29205# Battelle Columbus Labs., Ohio. Tactical Technology Center.
EVALUATION OF DATA MANAGEMENT FOR INSTALLA-

TION RESTORATION Final Report, Jun. 1977 - Feb. 1978
T. J. Thomas and G. J. Kovacs 28 Feb. 1978 53 p refs
(Contract DAAK40-73-C-0142)
(AD-A084777; BATT-CDIR-1-1; DRXTH-TD-CR-80067) Avail: NTIS HC A04/MF A01 CSCL 09/2

An external evaluation of the Data Management Program for the Operations of the Installation Restoration program is presented. Specific recommendations are made for the improvement of the Data Management Program. These recommendations cover management of the data log books, extra data fields to input error estimates, data, and free-form comments, system input stability, and required data sampling plans. In addition, a review of contaminant models is presented. Finally, a weakness in the quality control is presented, and a management information system is discussed. GRA

N80-29206# Executive Office of the President, Washington, D. C. Office of Administration.
TOWARD AN INFORMATION EFFICIENT EXECUTIVE OFFICE OF THE PRESIDENT
15 Feb. 1980 75 p refs
(PB80-167406) Avail: NTIS HC A04/MF A01 CSCL 05B

The political/policy decision making process is examined in terms of more efficient use of available information. The organization of the information to be accessed and improved support services are among the topics discussed. The role of the information processing systems in providing support services and automation of clerical activities are considered. J.M.S.

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N80-29207# Fondazione Ugo Bordoni, Rome (Italy).
MINIMUM COST FLOW IN AN ORIENTED GRAPH [FLUSSO DI COSTO MINIMO IN UN GRAFO ORIENTATO]
Giancarlo Pesamosca Mar. 1979 12 p refs In ITALIAN Presented at Intern. Conf. on Nonlinear Optimization and Appl., l'Aquila, 18-20 Jun. 1979
(FUB-4-1979) Avail: NTIS HC A02/MF A01

A procedure to determine minimum cost flow for arbitrary cost functions is presented. The procedure is derived as an improvement to Klein's, which is limited to linear or convex cost functions. However, determination of an absolute minimum is not guaranteed for the cases of nonlinear or concave functions. Author (ESA)

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see 03 *Air Transportation and Safety*, 16 *Space Transportation*, and 44 *Energy Production and Conversion*.

N80-29208# Department of Energy, Washington, D. C. Office of Transportation Programs.
CHARGE OF THE FUTURE: AN INTRODUCTION TO ELECTRIC AND HYBRID VEHICLES
Sep. 1979 75 p
(DOE/CS-0107) Avail: NTIS HC A04/MF A01

The past history and present development of electric vehicles are described. The Congressional focus on electric and hybrid vehicles and their reappraisal in light of environmental and energy concerns are addressed. In the near term, electric vehicles are neither intended nor expected to compete directly with internal combustion engine vehicles. DOE

N80-29209# Sandia Labs., Albuquerque, N. Mex.
STRATEGY FOR ASSESSING THE TECHNICAL, ENVIRONMENTAL AND ENGINEERING FEASIBILITY OF SUBSEABED DISPOSAL
D. R. Anderson, H. Herrmann, J. Kelly, and D. M. Talbert 1980 32 p refs Presented at 2nd Intern. Ocean Disposal Symp., Woods Hole, Mass., 15 Apr. 1980
(Contract EY-76-C-04-0789)
(SAND-79-2245C; CONF-800420-2) Avail: NTIS HC A03/MF A01

The strategy and management techniques used in the development of the US Subseabed Disposal Program (SDP) for possible disposal of both high-level waste and spent fuel are presented. The various components which make up the SDP strategy and management techniques are addressed. These include high-level waste and spent fuel disposal program and the position that the SDP occupies within that program; the technical and administrative tools which are employed to facilitate the day-to-day operation of the SDP; the current studies and future plans for addressing the legal, political, and international uncertainties that must be resolved prior to the time the SDP reaches the final engineering phases. DOE

N80-29210# Societe Nationale Industrielle Aerospatiale, Paris (France). Div. Systemes Balistiques et Spatiaux.
AEROSPACE TECHNOLOGY TRANSFER [RETOMBEES DE TECHNOLOGIE SPATIALES]
Didier Compard 3 Sep. 1979 36 p In FRENCH Presented at AFAS Ann. Congr. 'La Conquete de l'Espace', Tregastel, France, Sep. 1979
(SNIAS-792-422-112) Avail: NTIS HC A03/MF A01

The French policy for technology transfer from the aerospace industry is outlined. Some significant and promising candidates include: energy storage, electricial and magnetic components, medical equipment, and composite materials (carbon-carbon). Author (ESA)

N80-29211# Transportation Research Board, Washington, D.C.
TECHNOLOGY TRANSFER, THE RESEARCH PROCESS, AND CREATING A PRODUCTIVE ENVIRONMENT
W. L. Garrison, Robert C. Crawford, Al B. Linhares, George F. Linsteadt, Milton P. Criswell, James F. Shamblin, Dean Anklan, Dale E. Peterson, Robert P. Schmitt, and Edward A. Beimborn 1979 58 p refs
(PB80-173875; TRB/TRR-738; ISBN-0-309-02993-7; LC-80-12980; ISSN-0361-1981) Avail: NTIS HC A04/MF A01 PC also available from Transportation Research Board, 2101 Constitution Ave., NW., Washington, D.C. CSCL 13B

Several views of technology transfer and research and their effective utilization with an emphasis on transportation technology are presented. Federal, state, and local programs and activities for transportation technology transfer are examined. Also, the effectiveness of a research program, the role of management support for research, and the development of multidisciplinary research programs is addressed. GRA

N80-29212# Executive Office of the President, Washington, D. C.
BASIC AUTOMOTIVE RESEARCH IN THE DEPARTMENT OF TRANSPORTATION
Feb. 1980 29 p
(PB80-170020) Avail: NTIS HC A03/MF A01 CSCL 05A

Institutional and administrative arrangements necessary for the Dept. of Transportation to participate in the Industry/Government Cooperative Automotive Research Program are described. GRA

N80-29213# Baldwin (Fred D.), Carlisle, Pa.
THE NATIONAL CENTER FOR APPROPRIATE TECHNOLOGY: AN EVALUATION AT THE END OF ITS SECOND PROGRAM YEAR
Fred D. Baldwin and Laurence F. Kinney 30 Jun. 1979 87 p (PB80-166184; CSA-LN-2414) Avail: NTIS HC A05/MF A01 CSCL 05A

Management of the National Center for Appropriate Technology (NCAT) is evaluated. During its first year, NCAT built up a competent technical staff and launched some promising in-house work, but otherwise largely dissipated its small resources, even after allowance was made for the inevitability of start up problems. During its second year, however, it has made a remarkable recovery, in part by adopting more conventional priorities and management methods. In several areas, it is still spreading its resources too thinly. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-29214 Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.
HIGH ENERGY X-RAY OBSERVATION OF THE X-RAY BINARY 4U1700-37
W. Pietsch, W. Voges, C. Reppin, J. Truemper, E. Kendziorra (Tuebingen Univ., West Germany), and R. Staubert (Tuebingen Univ., West Germany) Oct. 1979 19 p refs Submitted for publication Sponsored in part by Deut. Forschungsgemeinschaft
(MPI-PAE/Extraterr-157; ISSN-0340-8922) Avail: Issuing Activity

During a 54 hr balloon flight from Alice Springs, Australia, on November 22-24, 1978 the X-ray binary 4U1700-37/HD153919 was observed in the energy range 20-180 keV for about two hours on each of three consecutive days. During one observation when the source was in binary eclipse no X-rays were detected from the source region. Flare type variability was seen up to a factor of 25, on time scales of minutes to hours. The source shows a thermal bremsstrahlung spectrum with a temperature kT = 28 keV which does not change significantly during the outbursts. This behavior is discussed in terms of current models for the accretion onto nonmagnetic neutron stars.
Author (ESA)

N80-29215# Lowell Observatory, Flagstaff, Ariz.
LOWELL PROPER MOTIONS 19: PROPER MOTION SURVEY IN THE SOUTHERN HEMISPHERE WITH THE 13 INCH PHOTOGRAPHIC TELESCOPE OF THE LOWELL OBSERVATORY
H. L. Giclas 10 Jul. 1979 10 p refs
(Grant NSF AST-77-25117)
(Lowell-Bull-165-Vol-8) Avail: NTIS HC A02/MF A01

A catalog including 174 stars having proper motions greater than 0.19 sec/year is presented. The position angle, blue magnitude, and star color are also indicated. The plate region is designated G158 ii and centered at RA 00(h)12(m).4 Dec. -9 deg 51 min. M.G.

N80-29216# Lowell Observatory, Flagstaff, Ariz.
LOWELL PROPER MOTION SURVEY: SUMMARY CATALOG OF GD AND GR STARS PROPER MOTION SURVEY WITH THE 13 INCH PHOTOGRAPHIC TELESCOPE OF THE LOWELL OBSERVATORY
H. L. Giclas, R. Burnham, Jr., and N. G. Thomas 17 Mar. 1980 50 p refs
(Grant NSF AST-77-25117)
(Lowell-Bull-166-Vol-8) Avail: NTIS HC A03/MF A01

A summary catalog listing 1712 white dwarf suspects and 504 very red stars all with proper motions < 0.20 sec/year is presented. The proper motion is given in seconds of arc per year for motion greater than 0.06 sec/year. Motion 0.06 sec/year or less is designated slight; and the position angle is rounded to the nearest 5 degrees. Motion 0.03 sec/year or less is also indicated. Estimates of the blue magnitude, star colors, photometry, and spectral type (if determined) are given. M.G.

N80-29217*# Harvard Univ., Cambridge, Mass.
HIGH RESOLUTION IMAGING AT LARGE TELESCOPES
P. Nisenson, R. Stachnik, C. Papaliolios, and Adelaide Hewitt, ed. May 1980 18 p refs Presented at the Kitt Peak Natl. Obs. Conf. on Opt. and Infrared Telescopes for the 1990's, Proc., Vol. 1, Tucson, Ariz., 7-12 Jan. 1980
(Grant NGR-22-007-228; Contract F19628-78-C-0026)
(NASA-CR-163393) Avail: NTIS HC A02/MF A01 CSCL 03A

Image recovery at a resolution limited only by diffraction is now possible at large telescopes. The theory of speckle image reconstruction is explained and the current status of a video recording and digitization system for the reconstruction procedure is described. Potential applications of the process when used with very large telescopes are discussed. The constraints on telescope design imposed by these techniques are listed. A.R.H.

N80-29218*# California Univ., Berkeley. Dept. of Astronomy.
ULTRAVIOLET OBSERVATIONS OF M32, A COSMOLOGICAL COMPARISON Final Report
Hyron Spinrad Jun. 1980 10 p refs
(Grant NsG-5360)
(NASA-CR-163371) Avail: NTIS HC A02/MF A01 CSCL 03A

The average spectral energy distribution for a sample of 3200 A. Spectral synthesis indicates that elliptical galaxies are most likely older than 9 Gyrs. The ultraviolet flux is consistent with a population of red horizontal branch stars, as those present in metal-rich globular clusters. Data for distant (Z approximately 1) first ranked cluster galaxies show indications of spectral evolution. Author

N80-29219*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ADVANCED X-RAY ASTROPHYSICS FACILITY (AXAF): SCIENCE WORKING GROUP REPORT
May 1980 182 p
(NASA-TM-78285) Avail: NTIS HC A09/MF A01 CSCL 03A

The Advanced X-Ray Astrophysics Facility (AXAF) mission concept is examined from a scientific viewpoint. A brief description of the development of X-ray astronomy and a summary description of AXAF, the scientific objectives of the facility, a description of representative scientific instruments, requirements for X-ray ground testing, and a summary of studies related to spacecraft and support subsystems, are included. E.D.K.

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-29220*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
EXOSPHERIC PERTURBATIONS BY RADIATION PRESSURE. 2: SOLUTION FOR ORBITS IN THE ECLIPTIC PLANE
Joseph W. Chamberlain 1980 20 p refs Sponsored in part by NSF
(Grant NsG-7043)
(NASA-CR-163373) Avail: NTIS HC A02/MF A01 CSCL 03B

The instantaneous rates of change for the orbital elements eccentricity, longitude of perigee from the Sun, and longitude from the Sun of the ascending node are integrated simultaneously

for the case of the inclination i = 0. The results confirm the validity of using mean rates when the orbits are tightly bound to the planet and serve as examples to be reproduced by the complicated numerical solutions required for arbitrary inclination. Strongly bound hydrogen atoms escaping from Earth due to radiation pressure do not seem a likely cause of the geotail extending in the anti-sun direction. Instead, radiation pressure will cause those particles' orbits to deteriorate into the Earth's atmosphere. A.R.H.

N80-29221*# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
BACKSTREAMING IONS OUTSIDE THE EARTH'S BOW SHOCK AND THEIR INTERACTION WITH THE SOLAR WIND
C. Bonifazi, A. Egidi, G. Moreno, and S. Orsini Jun. 1979 36 p refs Submitted for publication
(LPS-79-9) Avail: NTIS HC A03/MF A01

Plasma data supplied by the satellite ISEE 2 has confirmed the existence in the solar wind of two different ion populations (referred to as reflected and diffuse) backstreaming from the Earth's bow shock. The two populations have similar bulk velocities and flux densities, but quite different temperatures. In addition, the diffuse ions strongly interact with the solar wind, producing fluctuations in the distribution of the proton velocities, while the reflected ions do not disturb significantly the incoming solar wind. The origin of the two ion populations is discussed. The results seem to favor a model which explains the appearance of the diffuse population as the result of an interaction of the reflected ions with the solar wind. Author (ESA)

N80-29222# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
HIGH TIME RESOLUTION OBSERVATIONS OF THE SOLAR WIND IN THE EARTH'S FORESHOCK REGION
V. Formisano, S. Orsini, C. Bonifazi, A. Egidi, and G. Moreno Oct. 1979 22 p refs Submitted for publication
(LPS-79-13) Avail: NTIS HC A02/MF A01

The interaction of the solar wind with ions backstreaming from the Earth's bow shock was studied at high time resolution using the solar wind experiment on the ISEE 2 satellite. It was found that the bulk velocity of the solar wind oscillates, both in magnitude and direction, with typical periods of one minute in presence of the 'diffuse' ion population. Oscillations of comparable periods were also observed in the angular distribution and energy spectrum of the diffuse ions. Author (ESA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see 18 Spacecraft Design Testing, and Performance. For space stations see 15 Launch Vehicles and Space Vehicles.

N80-29223*# Howard Univ., Washington, D. C.
OH AND NH EMISSION STUDIES OF COMET KOHOUTEK
Final Report
C. K. Kumar [1980] 11 p refs
(Contract NsG-5021)
(NASA-CR-160005) Avail: NTIS HC A02/MF A01 CSCL 03B

A 30 inch flat mirror was used with the solar telescope of the Kitt Peak National Observatory to obtain the integrated disc spectrum of the Sun between the wavelengths of 3000A and 4000A at a resolution of about two hundred thousand. The data obtained were used to calculate the intensities of the fluorescent lines of the OH radical in comets. The results were compared with those obtained using the center of the disc spectrum only. The wavelength of the reference point and the dispersion from which the wavelength of other points can be obtained are presented in tabular form. A.R.H.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-29224*# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
THE DISTRIBUTION OF MAXIMUM TEMPERATURES OF CORONAL ACTIVE REGION LOOPS
E. B. Mayfield and R. G. Teske (Michigan Univ., Ann Arbor) 15 May 1980 37 p refs
(Contract NAS8-33112)
(NASA-CR-161527; ATR-80(7813)-1) Avail: NTIS HC A03/MF A01 CSCL 03B

The emission measure distribution across the range 4.5 < log T < 6.5 was derived for several coronal active regions by combining EUV line fluxes with broadband X-ray fluxes. The distributions of the maximum temperature was then derived using a numerical model. It is shown that the emission measure distribution can be represented over the full range 5.6 log Tm < 6.5 by the superposition of simple loop models, if the models incorporate a substantial rise in their individual emission measure distributions near the maximum temperature. The unresolved loops may have substantial area ratios, since it is this ratio that fixes the extent of the rise in the emission measure distribution. Since the bulk of the emission measure is then contributed from the loop tops, the distribution of maximum temperatures has approximately the same shape as does the integrated emission measure distributions. The EUV and X-ray data used were obtained by from two separate experiments on ATM/Skylab. A.R.H.

N80-29225# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
PROPERTIES OF MAGNETOHYDRODYNAMIC TURBULENCE IN THE SOLAR WIND
M. Dobrowolny, A. Mangeney (Observatoire de Meudon), and P. L. Veltri (Cosenza Univ.) Jan. 1979 27 p refs
(LPS-79-1) Avail: NTIS HC A03/MF A01

Using incompressible magnetohydrodynamics, information on the nature of the MHD turbulence observed in the trailing edges of high velocity streams in the solar wind was derived. This turbulence is characterized to a good degree, by the absence of nonlinear wave interactions. The turbulence is a mixture of modes with polarization of Alfvenic and slow magnetosonic types. A theoretical model of MHD turbulence, satisfying some observational constraints, is used to calculate a variance matrix and interpret the main results of the minimum variance analysis of magnetic data. Author (ESA)

N80-29226# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
HIGH-SPEED SOLAR WIND STREAMS AND GALACTIC COSMIC RAY MODULATION
N. Iucci (Rome Univ.), M. Parisi, M. Storini, and G. Villoresi Jun. 1979 32 p refs Sponsored by Italian National Research Council
(LPS-79-10) Avail: NTIS HC A03/MF A01

Two classes of fast solar wind streams are identified: quiet streams, coming from near equatorial holes, the stream interface is in the initial phase followed by low proton density, quiet interplanetary magnetic field with constant polarity and proton temperature following the wind speed time profile; perturbed streams, coming from active regions producing type 4 solar flares, for which the previous requirements are not satisfied. Superposed epoch analyses applied to solar wind speed and neutron monitor intensity show that during the highspeed streams presumably coming from coronal holes the cosmic ray intensity is depressed; the time behavior of this depression follows the time profile of the wind speed to be determined. The perturbed streams are accompanied by Forbush decreases whose amplitude and time behavior are not directly related to the speed increase.
Author (ESA)

N80-29227# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
THE CHEMICAL COMPOSITION OF THE SUN
G. Moreno and C. Bonifazi Nov. 1979 62 p refs

(LPS-79-15) Avail: NTIS HC A04/MF A01

The present status of knowledge of the Sun's chemical composition is reviewed. Photospheric, chromospheric and coronal abundances of the different elements are first studied separately and then compared to check the chemical homogeneity of the solar atmosphere. Photospheric abundances are also compared with those of the carbonaceous chondrites to get information on the chemical composition of the primordial nebula from which the solar system originated. Author (ESA)

N80-29228# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.

SOLAR-GEOPHYSICAL DATA NO. 425, JANUARY 1980. PART 1: PROMPT REPORTS. DATA FOR DECEMBER 1979, NOVEMBER 1979

Helen E. Coffey, ed. Jan. 1980 157 p

(PB80-166218; SGD-425-Pt-1; NOAA-80022801) Avail: NTIS HC A08/MF A01 CSCL 03B

In addition to an index for 1979, this prompt report provides data for December 1979 on: alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observations, solar wind measurements, infrared interplanetary magnetic field polarities, mean solar magnetic field, coronal holes, and Boulder Geomagnetic Substorm Log. It also provides data for November 1979 on: daily solar activity center, sudden ionospheric disturbances, solar X-ray radiation, solar emission, cosmic rays, geomagnetic indices, and radio propagation indices. GRA

N80-29229# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.

SOLAR-GEOPHYSICAL DATA NO. 425, JANUARY 1980. PART 2: COMPREHENSIVE REPORTS. DATA FOR JULY 1979

Helen E. Coffey, ed. Jan. 1980 38 p

(PB80-166226; SGD-425-Pt-2; NOAA-80022802) Avail: NTIS HC A03/MF A01 CSCL 03B

In addition to an index for 1979, this issue of comprehensive reports provides data for July 1979 on: solar radio emission, energetic solar particles, and plasma and solar X-ray radiation. The miscellaneous data includes the coronal holes and spacecraft observations for November 1979, cosmic rays for September 1979, and geomagnetic indices for October 1979. GRA

N80-29230# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.

SOLAR-GEOPHYSICAL DATA NO. 422, OCTOBER 1979, PART 1 (PROMPT REPORT) Data Report, Sep. - Aug. 1979

Helen E. Coffey Oct. 1979 183 p

(PB80-174527; SGD-422-Pt-1; NOAA-79112302) Avail: NTIS HC A09/MF A01 CSCL 03B

This prompt report provides data for September 1979 on: alert periods, daily solar indices, solar flares, solar radio emission, spacecraft observation, coronal holes, solar wind measurements, inferred interplanetary magnetic field polarities, mean solar magnetic field, and Boulder Geomagnetic Substorm Log. It also provides data for August 1979 on: daily solar activity center, sudden ionospheric disturbances, solar X-ray radiation, solar radio emission, cosmic rays, geomagnetic indices, and radio propagation indices. GRA

N80-29231# National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo.

SOLAR-GEOPHYSICAL DATA NO. 422, OCTOBER 1979, PART 2 (COMPREHENSIVE REPORTS) Data Report, Feb. 1979 - Apr. 1979

Helen E. Coffey, ed. 15 Aug. 1980 96 p

(PB80-174535; SGD-422-Pt-2; NOAA-79112303) Avail: NTIS HC A05/MF A01 CSCL 03B

This comprehensive report provides data for April 1979 on: solar radio emission, energetic solar particles and plasma, and solar X-ray radiation. The data for February 1979 consists of: solar flares, synoptic charts, and abbreviated calendar record. The miscellaneous data includes daily solar indices, solar radio emission for July and August 1979, solar wind measurement, for August 1979, geomagnetic indices July 1979, and regional flare index for January 1979. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see 52 *Aerospace Medicine*. For theory see 73 *Nuclear and High-Energy Physics*.

N80-29232 Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrisch Physik.

COMPTON SCATTERING MODEL FOR THE GAMMA RAY EMISSION OF NGC 4151

K. Pinkau Nov. 1979 20 p refs Submitted for publication (MPI-PAE/Extraterr-159) Avail: Issuing Activity

It is shown that electron lifetimes against Compton losses in NGC 4151 are 2-3 weeks and thus sufficiently large to allow burst-like injection of electrons. Electron pile-up accurately explains the observed gamma ray spectrum and cut-off. The total energy content of the burst must then have been of the order of 10 to the 51st power ergs. If this model is correct, the gamma ray spectrum must be highly time variable. Author (ESA)

N80-29233# Magnetic Observatory, Hermanus (South Africa).

HERMANUS NEUTRON MONITOR DATA, 1978

1979 55 p

(CSIR-MAG-D13; ISBN-0-7988-1625-2) Avail: NTIS HC A04/MF A01

Corrected and uncorrected Hermanus neutron monitor data are presented in tabular form. In addition, barometric pressure, graphs of corrected Potchefstroom and Hermanus monitor data, and the ratio Potchefstroom corrected counts/Hermanus corrected counts are given. The Hermanus 12 NM 64 monitor consists of two separate neutron monitor piles: a 3 NM pile with additional paraffin wax shielding and a regular 9 NM. The monitor is located at an elevation of 26 meters above mean sea level and geographic coordinates of lat. 34 deg 25 min S., long. 19 deg 13 min E. M.G.

N80-29234*# National Aeronautics and Space Administration, Washington, D. C.

QUASARS: ACTIVE NUCLEI OF YOUNG GALAXIES

B. V. Komberg 29 May 1980 20 p refs Transl. into ENGLISH of "Kvazary - Aktivnyye Yadra v Molodykh Galaktikakh", Rept. Pr-358 Acad. of Sci. USSR, Moscow, 1977 25 p Transl. by Kanner (Leo) Associates, Redwood City, Calif.

(Contract NASw-3199)

(NASA-TM-76233; Pr-358) Avail: NTIS HC A02/MF A01 CSCL 03B

The hypothetical properties of 'young' galaxies and possible methods of observing them are discussed. It is proposed that star formation first takes place in the central regions of protogalaxies which may appear as quasar-like objects. An evolutionary scheme is outlined in which the radio quasars are transformed in time into the nuclei of radio galaxies. Author

N80-29235*# National Aeronautics and Space Administration, Washington, D. C.

DETERMINATION OF THE TIME OF OCCURRENCE OF GAMMA FLARES AT DIFFERENT POINTS IN SPACE

B. L. Novak Jun. 1980 16 p refs Transl. into ENGLISH of "Opredeleniye Bremen Prokhozhdeniya Gamma-Vspleskom Razlichnykh Tochek Kosmicheskogo Prostranstva", Rept. Pr-352 Acad. of Sci. USSR, Moscow, 1977 16 p Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-76236; Pr-352) Avail: NTIS HC A02/MF A01 CSCL 03B

The problem of determining the time of occurrence of gamma flares at different points in space is considered. This problem arises in the localization of sources of gamma flares by the triangulation method using several spacecraft. A study is made of different methods for determining the time at which the flare reaches the spacecraft and algorithms are given for estimating their accuracy. Results of processing the model information are also given. L.F.M.

N80-29236# Los Alamos Scientific Lab., N. Mex. Nuclear Chemistry Group.

LUNAR RADIONUCLIDE RECORDS OF AVERAGE SOLAR-COSMIC-RAY FLUXES OVER THE LAST TEN MILLION YEARS

Robert C. Reedy 21 Mar. 1980 44 p refs Presented at the Lunar and Planetary Inst. Topical Conf. on the Ancient Sun, Boulder, Colo., Oct. 1979

(Contract W-7405-eng-36)

(LA-UR-928; CONF-7910123-4) Avail: NTIS HC A03/MF A01

Because changes in solar activity can modify the fluxes of cosmic-ray particles in the solar system, the nature of the galactic and solar cosmic rays and their interactions with matter are described and used to study the ancient Sun. The use of cosmogenic nuclides in meteorites and lunar samples as detectors of past cosmic ray variations are discussed. Meteorite records of the history of the galactic cosmic rays are reviewed. The fluxes of solar protons over various time periods as determined from lunar radionuclide data are presented and examined. The intensities of solar protons emitted during 1954 to 1964 (11 year solar cycle number 19) were much larger than those for 1965 to 1975 (solar cycle 20). Average solar proton fluxes determined for the last one to ten million years form lunar AL-26 and Mn-53 data show little variation and are similar to the fluxes for recent solar cycles. DOE

N80-29237# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

COSMIC RAY NM-64 NEUTRON MONITOR DATA-6, JANUARY - DECEMBER 1977 (ROME, ITALY)

G. Villoresi, N. L. Zangrilli, A. Felici, F. Re, and F. Signoretti Jan. 1979 30 p refs Prepared in cooperation with Rome Univ., Italy

(LPS-79-2) Avail: NTIS HC A03/MF A01

Pressure-corrected data from the Rome neutron monitor and barometric pressure data are given in tabular form for the year 1977, together with the graphs of the corrected intensity. Details on the devices employed, operational mode and data handling are given. Author (ESA)

N80-29238# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

COSMIC RAY NM-64 NEUTRON MONITOR DATA-7, JANUARY - DECEMBER 1978 (ROME, ITALY)

G. Villoresi, N. L. Zangrilli, A. Felici, F. Re, and F. Signoretti Mar. 1979 32 p refs Prepared in cooperation with Rome Univ., Italy

(LPS-79-4) Avail: NTIS HC A03/MF A01

Pressure-corrected data from the Rome neutron monitor and barometric pressure data are given in tabular form for the year 1978, together with the graphs of the corrected intensity. Details on the devices employed, operational mode and data handling are given. Author (ESA)

N80-29239# Laboratorio di Ricerca e Technologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

THE COSMIC RAY STORM OF FEBRUARY 15, 1978

N. Iucci (Rome Univ.), M. Parisi, M. Storini, G. Villoresi, and N. L. Zangrilli Jun. 1979 15 p refs Sponsored by Italian National Research Council

(LPS-79-8) Avail: NTIS HC A02/MF A01

During the Forbush decrease of February 14, 1978 a huge cosmic ray decrease lasting 10 hours was observed by neutron monitoring stations. A detailed analysis, performed on data of numerous neutron monitors, shows that this event was a bidirectional anisotropy with a cosmic ray density gradient rising from a plane tilted 30 deg with respect to the Earth equator; the interplanetary magnetic field should be perpendicular to that plane. Author (ESA)

99 GENERAL

N80-29240# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).

[GERMAN AEROSPACE RESEARCH ACTIVITIES FOR 1978]

Annual Report

1979 161 p refs In GERMAN Original contains color illustrations

Avail: NTIS HC A08/MF A01

Research activities are outlined in the following areas: transportation and communication systems; aerospace technology; solar energy; aerospace materials; aerodynamics; data processing; meteorology; and Spacelab collaboration. Author (ESA)

N80-29241# National Bureau of Standards, Washington, D.C.

DIMENSIONS/NBS, VOLUME 64, NO. 1, FEBRUARY 1980

Feb. 1980 29 p refs

(PB80-169527; NBS-DIM-64/1) Avail: NTIS HC A03/MF A01 CSCL 14B

Major technical developments, works in progress, major speeches, and statements by Bureau management, and a list of NBS publications are presented. Topics covered include: (1) the use of standard reference materials to assure quality and provide equity for consumers and producers; (2) computer models of energy and economic systems for operations research; (3) attaining improved values of fundamental physical constants such as gas constants, Rydberg constant, and electron-photon mass ratio; (4) gas standard reference materials for emissions testing of heavy duty motor vehicles; (5) eddy current imaging system; (6) calculating atomic properties; and (7) the resolution of photon-recoil components of the visible line spectral line. A.R.H.

N80-29242# National Bureau of Standards, Washington, D.C.

DIMENSIONS/NBS, VOLUME 64, NO. 2, MARCH 1980

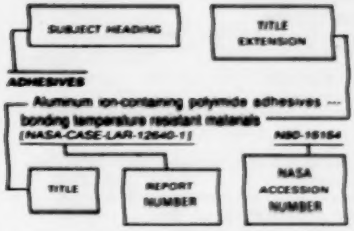
Mar. 1980 40 p refs

(PB80-169535; NBS-DIM-64/2) Avail: NTIS HC A03/MF A01 CSCL 14B

Methods for evaluating symbols to determine the effectiveness of pictograms in communication are described. The interactions between the chemistry of metals and the biology of microorganisms are examined in an effort to develop antifouling paints for ship hulls. Methods for more rapid measurements and for process control in the production of semiconductors for very large scale integration are also considered. Other topics covered include gamma ray measurements, using polarized electrons to study surface magnetism, measuring the organic constituents of human serum, and the NBS industrial furnace facility. A.R.H.

SUBJECT INDEX

Typical Subject Index Listing



The subject heading is the key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The NASA accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus* (NASA SP-7050).

A

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(NASA-TM-81823) N80-28418

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Kevlar properties investigation high speed abrasion resistance
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ABSORBERS (MATERIALS)
Energy savings obtainable through passive solar techniques
(LA-UR-80-746) N80-28891

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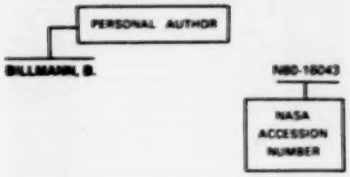

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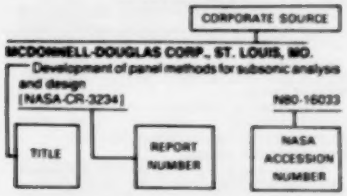

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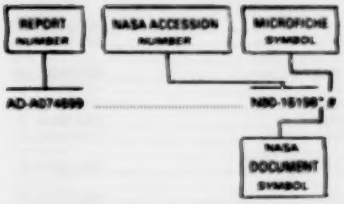

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NATICK/TR-80/011 ..... N80-28433 #

NBS-DIM-64/1 ..... N80-29241 #
NBS-DIM-64/2 ..... N80-29242 #

NBS-GCR-79-185 ..... N80-29164 #

NBS-SP-545 ..... N80-29162 #

NBS-TN-1017 ..... N80-28863 #
NBS-TN-1019 ..... N80-29163 #

NEFES-80-63 ..... N80-29063 #

NESEA-79-30-22-REV. ..... N80-28332 #
NESEA-022-106A-REV ..... N80-28332 #

NOAA-TM-NWS-WR-149 ..... N80-29003 #

NOAA-79112302 ..... N80-29230 #
NOAA-79112303 ..... N80-29231 #
NOAA-80022011 ..... N80-29004 #
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NOAA-80022802 ..... N80-29229 #
NOAA-80030701 ..... N80-29003 #

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NPS55-79-029 ..... N80-29079 #
NPS55-80-007 ..... N80-29068 #
NPS67-80-003 ..... N80-28704 #

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NRL-MR-4192 ..... N80-29175 #
NRL-MR-4193 ..... N80-29193 #
NRL-MR-4195 ..... N80-28968 #
NRL-MR-4202 ..... N80-28722 #
NRL-MR-4209 ..... N80-28960 #

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NSF/RA-790361 ..... N80-28763 #
NSF/RA-790363 ..... N80-28764 #
NSF/RA-790395 ..... N80-28577 #

NSWC/TR-79-247 ..... N80-28869 #
NSWC/TR-80-65 ..... N80-28540 #

NTIA/REPT-80/35 ..... N80-28627 #

NTIS/DF-80/003A ..... N80-28957 #

NTIS/PS-78/0120 ..... N80-29036 #
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NTIS/PS-78/0145 ..... N80-28368 #
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NTIS/PS-78/0215 ..... N80-28664 #
NTIS/PS-78/0216 ..... N80-28665 #
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NUSC-TR-6239 ..... N80-28592 #
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NVO-1603-2 ..... N80-29196 #

N109 ..... N80-28736 #

OEG-PP-294 ..... N80-29078 #

ONR-CR-215-245-3 ..... N80-28374 #

ONR-TR-80-1 ..... N80-28749 #

ONWI-59 ..... N80-29155 #
ONWI-60 ..... N80-29149 #

ORNL/EIS-163/V1-P1 ..... N80-29029 #
ORNL/EIS-163/V1-P2 ..... N80-29030 #

ORNL/MIT-298 ..... N80-28485 #

ORNL/SUB-79/45740/1 ..... N80-28915 #

ORO-5262-5-SUPPL ..... N80-28857 #
ORO-5362-T1 ..... N80-28860 #

OTA-E-110 ..... N80-28574 #

OTA-T-112-PT-1 ..... N80-28326 #

OWRT-A-087-IDA(1) ..... N80-28854 #
OWRT-A-102-MICH(3) ..... N80-29020 #

PB80-154248 ..... N80-28572 #
PB80-154255 ..... N80-28573 #
PB80-158744 ..... N80-28936 #
PB80-158751 ..... N80-28937 #
PB80-159965 ..... N80-29018 #
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PNL-SA-7737 ..... N80-29160 #
PNL-SA-7746 ..... N80-28760 #
PNL-SA-8011 ..... N80-29150 #

PNL-TR-375 ..... N80-28477 #

PNL-3160-3 ..... N80-28675 #

PPPL-1651 ..... N80-28611 #

PR-3 ..... N80-28560 #
PR-352 ..... N80-29235* #
PR-358 ..... N80-29234* #
PR-397 ..... N80-28848* #

PRRL-79-CR-48 ..... N80-28907 #

PUBL-79-014 ..... N80-28690* #

PWA-FR-11844 ..... N80-28365 #

PWA-5580-32 ..... N80-28306* #

QPR-3 ..... N80-28901 #
QPR-15 ..... N80-28478 #

QR-1 ..... N80-28482 #
QR-1 ..... N80-28586 #
QR-2 ..... N80-28545 #
QR-3 ..... N80-28546 #
QR-3 ..... N80-28553 #
QR-3 ..... N80-28603 #
QR-9 ..... N80-28479 #
QR-10 ..... N80-28552 #
QR-20 ..... N80-28562 #

QSD-1366 ..... N80-28586 #

QTPR-1 ..... N80-28899 #
QTPR-2 ..... N80-28898 #
QTPR-3 ..... N80-28881 #
QTPR-3 ..... N80-28895 #

R-842 ..... N80-29050 #
R-846 ..... N80-29069 #
R-847 ..... N80-29070 #
R-849 ..... N80-29137 #
R-856 ..... N80-28653 #
R-861 ..... N80-29071 #
R-865 ..... N80-29072 #
R-1330 ..... N80-28721 #
R-1386 ..... N80-28384* #

RADC-TR-79-331 ..... N80-28646 #
RADC-TR-80-25 ..... N80-28585 #
RADC-TR-80-48-VOL-1 ..... N80-28609 #
RADC-TR-80-48-VOL-2 ..... N80-28610 #
RADC-TR-80-77 ..... N80-28643 #

RAE-LIB-TRANS-2038 ..... N80-28497 #

RAE-TR-77110 ..... N80-28323 #

REL/R(79)24 ..... N80-28731 #

REPT-2 ..... N80-29146 #
REPT-22-3040-FNL ..... N80-28655 #
REPT-22-3040-FNL-SUPPL ..... N80-28654 #
REPT-46 ..... N80-28572 #
REPT-46-APP ..... N80-28573 #
REPT-67/1978 ..... N80-28968 #
REPT-77-104 ..... N80-29186 #
REPT-77-119 ..... N80-29187 #
REPT-78-FM-51-VOL-5-APP-D ..... N80-28409* #
REPT-80-FM-32 ..... N80-29075* #
REPT-80-FM-36 ..... N80-29043* #
REPT-80-FM-39 ..... N80-28415* #
REPT-80-FM-42 ..... N80-29074* #
REPT-80F5121 ..... N80-28424* #
REPT-523-0769373-00121D-2 ..... N80-28651 #
REPT-1366-A ..... N80-29040 #
REPT-3420-FARO-14396.10-E ..... N80-28541 #
REPT-5121.5869.6.1-5 ..... N80-28425* #

RFP-3033/3533/79-4 ..... N80-28926 #
RFP-3035/3533/79-10 ..... N80-28925 #

RI/RD80-155-1-VOL-1 ..... N80-28427* #
RI/RD80-155-2-VOL-2-A ..... N80-28428* #

RLO-2227-T24-79/1 ..... N80-28996 #

R79-954390-13 ..... N80-28463* #
R79AEG416-VOL-1 ..... N80-28499* #
R8007-5 ..... N80-28583* #

SAAB-RRK-79-58 ..... N80-28733 #

SAI-78-604-LJ ..... N80-28978 #
SAI-78-604-LJ-2B-VOL-14C ..... N80-28966 #

SAM-TR-79-30-VOL-1 ..... N80-29325 #

SAMSO-TR-79-93 ..... N80-28873 #

SAN/1731-T2 ..... N80-28856 #

SAND-79-0845 ..... N80-28484 #
SAND-79-1858C ..... N80-28723 #
SAND-79-1847 ..... N80-28568 #
SAND-79-1990 ..... N80-28755 #
SAND-79-2032 ..... N80-28876 #
SAND-79-2056 ..... N80-28878 #
SAND-79-2245C ..... N80-29209 #
SAND-79-2292C ..... N80-28914 #
SAND-80-0181 ..... N80-29058 #
SAND-80-0190 ..... N80-28758 #
SAND-80-0197 ..... N80-29059 #
SAND-80-0309 ..... N80-28874 #
SAND-80-0482 ..... N80-29562 #
SAND-80-0748C ..... N80-28454 #
SAND-80-0801C ..... N80-28912 #
SAND-80-5080C ..... N80-28927 #
SAND-80-8006 ..... N80-29533 #
SAND-80-7006 ..... N80-28908 #
SAND-80-7026 ..... N80-29041 #
SAND-80-8175 ..... N80-28924 #

SAR-38 ..... N80-28339* #

SASR-6 ..... N80-29190* #

SCIENTIFIC-1 ..... N80-28969 #
SCIENTIFIC-2 ..... N80-28967 #
SCIENTIFIC-3 ..... N80-28430 #

SC5187.13FR ..... N80-28593 #
SC5210.24AR ..... N80-29191* #

SD-TR-80-19 ..... N80-28877 #
SD-TR-80-20 ..... N80-28419 #
SD-TR-80-24 ..... N80-28872 #

SER-510025 ..... N80-28351 #

SERI/TP-333-507 ..... N80-28585 #
SERI/TP-635-469 ..... N80-28892 #

SERI/TR-35-078-VOL-3 ..... N80-28569 #
SERI/TR-351-494 ..... N80-28894 #
SERI/TR-632-439 ..... N80-28893 #

SEVILLE-TR-79-12 ..... N80-28379 #

SGD-422-PT-1 ..... N80-29230 #
SGD-422-PT-2 ..... N80-29231 #
SGD-425-PT-1 ..... N80-29228 #
SGD-425-PT-2 ..... N80-29229 #

SIT-P2002-1179 ..... N80-29176 #

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